AMERICAN MACHINIST

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The Chandler & Silver Water Motor.

This machine, which is of the cylinder type, is so constructed as to automatically vary the capacity of the cylinders to meet the requirements of the load, whereby only the exact amount of water at the obtainable pressure is used, and should not be confounded with the class of water motors in which the regulation is obtained by wire drawing, and in which substantially the same amount of water is used for a light as for a heavy load. The construction is shown in the sectional views, Figs. 1, 2 and 3, and by the perspective views. Similar parts are designated by the same figures in all the engravings.

Fig. 1 represents a longitudinal section through the cylinder end of the machine, on the line, *A B*, Fig. 2. Fig. 2 is a cross section of the cylinder, and Fig. 3 a plan of the valve or port face.

The cylinders 1, 2, 3, 4, 5 are arranged concentrically around a central spindle 17, and are comprised in a single casting of bronze.

To the cylinders are fitted pistons, 12, 13, from which connecting rods, 18, extend to the crank disk, 21, which is firmly keyed to the shaft 23. The cylinders revolve by and over the stationary ports, 6, 7, and the port faces, 8, 9; 6 being the supply and 7 the discharge port. The direction of revolution is from left to right, or in the direction of the figures 1, 2, 3 &c., Fig. 2.,

As each cylinder passes the face 9, at the instant of completing its inward or downward stroke, it opens into the supply port 6, and takes water during the whole of its upward or outward stroke, until at its completion it passes the face 8, which cuts off the supply of water to the cylinder, and at the same time opens it into the discharge port. As there are no ports or passages between the cylinders and valve face, there is no loss of pressure from friction of water in contracted spaces, all the pressure in the water chamber being utilized at the pistons. As there are a number of cylinders consecutively taking water at the same point, two or more cylinders being always in action, the variation in flow is very small, and the jar or water hammer is scarcely perceptible at even the highest speed, which is limited only by the ability of the water to follow the pistons. The smaller sizes have been run, we are told, at from 1,500 to 2,000 revolutions per minute, without being fastened to the floor, and were perfectly steady. The larger sizes have been run at correspondingly high speeds. A machine rated at 7 horse-power, having five cylinders of 2½ inches diameter by 4½ inches maximum stroke, has been run at from 500 to 600 revolutions per minute, corresponding to a piston speed of 187 to 225 feet per minute.

The makers have one of this size in use, which is required to run at 450 revolutions per minute for its regular work.

The pressure against the partitions between the cylinders tends to force the cylinder casting away from the face, 10, and the thin film of water which is always interposed between them, effectually lubricates the faces and prevents metallic contact or abrasion. This pressure is resisted by the collar bearing, 14, 15, on the spindle, 17, and means of adjustment is provided by the nuts, 16, at its lower end. The spindle 17, is hollow, and through it oil is fed to its bearing in the cylinder casting, and to the collars 14, 15, being supplied through a tube.

The connecting rods, which are of steel, are provided with spherical ends, one end being seated in the bronze bushing or slip 20, in the crank disc, and the other in the piston.

The cylinder casting is rotated by the gears, 24, 25. These gears are of such a construction that they run correctly and smoothly whatever may be the angle between the cylinders and crank disk. These gears have been fully described in the AMERICAN MACHINIST of Jan. 20, 1883, and need not be shown in detail here. This capability of running at any angle is a necessity on account of the construction adopted for varying the stroke.

The arrangement for oiling the connecting rod bearings consists of an annular groove, 22, surrounding the main shaft bearing, 23, which groove catches the overflow from the bearing and conveys it to the ball ends through the oil holes shown.

The pistons are packed with leather rings. Any leakage of water by them, or at the valve face, is caught by the bonnets, 27, and escapes by the overflow, 26.

The casting, forming the water chamber, is supported on trunnions at either side of the machine, the axis of which is tangent to the circle described by the connecting-rod ends, 19. These trunnions are hollow, and through them the water flows, being conducted to and from the water chamber through the side pipes.

Before reaching the trunnions on the supply side of the motor, the water passes the throttle valve, which is connected to and controlled by the governor. This governor is of the high-speed, spring type, and is very sensitive.

As liquids exert pressure equally in all directions, the water, in exerting pressure on the pistons, reacts on the opposite direction against the back of the water chamber, 29, tending to swing the movable parts backward and downward.

This tendency, as well as the weight of the chamber and attachments, is balanced by weights adjustable on levers. These weights are so adjusted that the maximum pressure of water obtainable is just sufficient to push the cylinders out to the position of full stroke, when running under the maximum load.

As any portion of the load is thrown off, the slight consequent increase in speed of the regulator contracts the opening of the throttle valve, and slightly reduces the pressure in the water chamber. The weight then falls until it is balanced by the reduced pressure in the water chamber, which at the same time rises, and, reducing the angle between the cylinder and crank disk, thereby proportionally lessens the stroke.

At an increase of load the reverse of this occurs. The variation in pressure required to change from maximum to minimum stroke is but a few pounds, which loss is very small when compared with that due to the ordinary system of regulation.

It will be noticed that when the machine is running the pistons are divided into two sets, moving in opposite directions, and consequently the machine is as sensitive to changes of cylinder pressure as if the pistons were absolutely frictionless. These motors will change the stroke so quickly that movement is plainly perceptible at every stroke of such machines as small planers, or at every impression of a cylinder printing press, running at 1200 to 1400 impressions per hour.

As the axis of the trunnions on which the water chamber oscillates intersects the axes of the connecting rods when they are passing the lower center, the clearance is constant for all lengths of stroke.

The theory of the machine may be explained as follows: Referring to Fig. 6, page 2, in which *O X* is the axis of the main

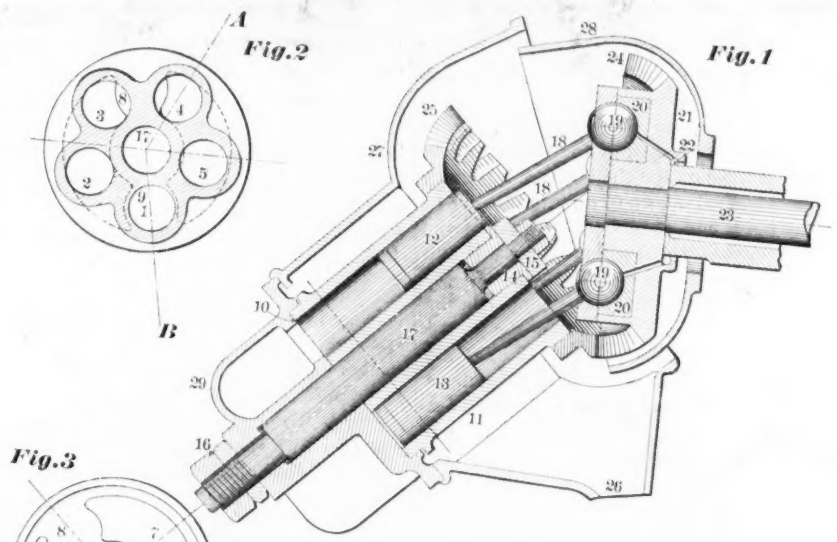
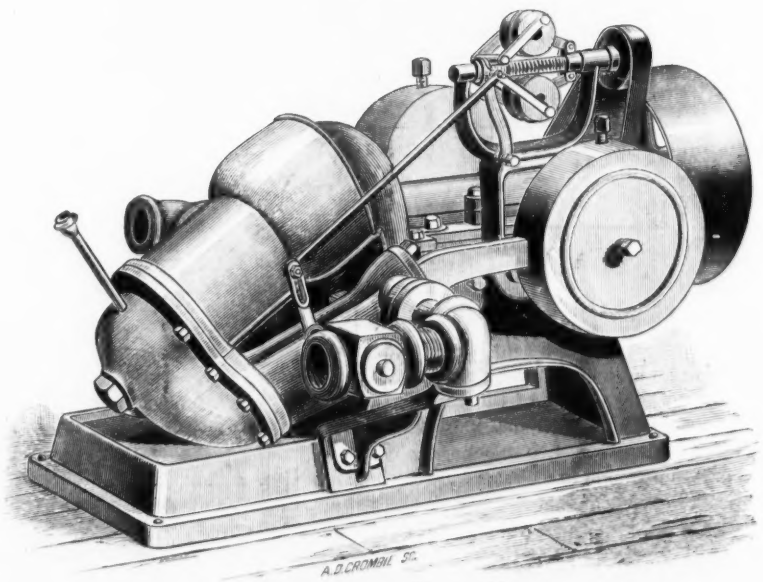


FIG. 5.



OUTSIDE VIEW OF WATER MOTOR.

shaft, and *C A B* the circle described by the outer ends of the connecting rods, attached to the crank disk. *L A* and *K B* are the axes of connecting rods at half and full outward stroke, and also represent the direction of pressure from the pistons to the crank disk.

Let the intensity of the pressure on any rod at mid-stroke be represented by *DA*, which pressure may be resolved into two components, *AF* and *AE*, two sides of a rectangle of which *AD* is the diagonal. The force, *EA*, is parallel to the axis, *OX*, and as far as the action of the machine is concerned, results only in end pressure on the shaft. The force, *FA*, is perpendicular to the radius, *AO*, being tangent to the circle, *CAB*, and tends to produce rotation about the axis, *O X*. As the pistons approach the upper center or end of the outward stroke, the component, *AF*, which is always perpendicular to the common plane of the axis, makes a continually decreasing angle with the radius *AO*, until at the end of the stroke it coincides with it, and the arm of the movement becomes zero.

Let *BCJ* represent the angle between the plane of rotation of the crank disk and the plane normal to the axis of the cylinders. The forces *AL*, *KB*, are perpendicular to the line *C, J*. Then, as the angle *BCJ*, decreases, so also does the similar angle, *DAE*. Now the side, *AF*, of the parallelogram, *DFAE*, is proportional to the sine of the angle *DAE*. From this it follows that the rotative movement transmitted is proportional to the sine of the angle between the cylinder and crank disk, and consequently to the consumption of water.

Fig. 5 represents the smaller sizes of the machines, which are especially designed for running machinery of all kinds requiring less than 1 H. P. They are especially adapted to running coffee and spice mills, light printing presses and any light machinery. They are invariable as to their stroke, and are not quite as economical in consequence as the larger machines, although in this respect the makers claim that they surpass any attempts previously made.

The larger sizes are especially adapted to driving elevators, as they use only enough water to make the lift, proportioning the consumption exactly to the weight lifted. These machines have been used for driving circular saws, lathes, planers, printing presses, and in fact for almost every purpose for which not more than ten to twelve horse-power is required.

The makers are the Chandler Water Motor Company, whose Boston office is at 1,325 Washington street.

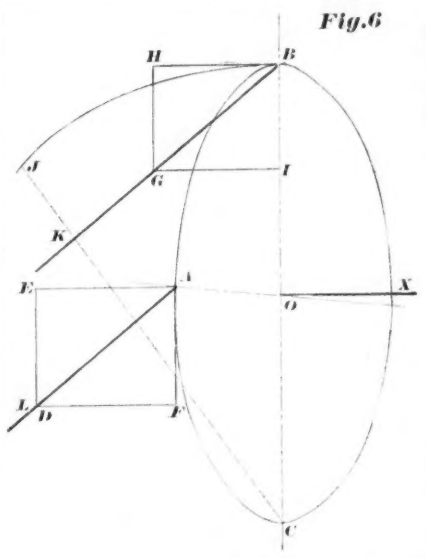
The motors are being introduced into Australia by James A. Roberts, Melbourne.

British working machinists and inventors are very much pleased with the changes in the patent laws, which enable them to protect any useful inventions they may originate. Hitherto British patent laws have been a protection to capital alone. It was notorious there, that moneyless inventors were nearly always cheated out of the products of their ingenuity or inventive genius. The development of British machinery supplies a long record of moneyed men getting credit for inventions which they never devised. Appliances that in many instances brought fame and increased fortune to men already rich, were purchased from the real inventors for a trifle. No more pathetic story of human wrong exists than that of British inventors who suffered by being debarred from protecting their own by the obstacle of exorbitant patent fees.

Points in the Shop System at the Hancock Inspirator Works.

At the works of the Hancock Inspirator Company, in Boston, we noticed recently a novel system in the arrangement of special tools. The various operations on the shells or cases of the inspirator require the use of a variety of tools for boring, reaming, facing, cutting seats, &c., and these tools are carried

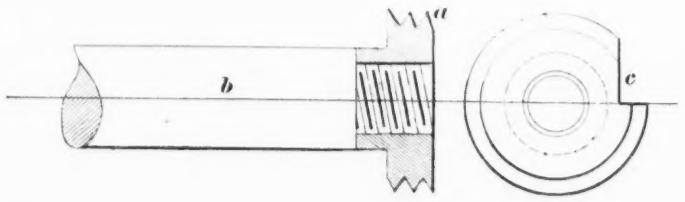
Fig.6



in the spindles of ten upright drills, arranged in a row so that the tables clamped at a uniform height will just touch one another, making as it were a continuous table or platen the entire length of the line of drills. The operations on the shell of an inspirator are commenced at one end of this line of cutting tools, and when the shell reaches the other end, being slid along from table to table, the operations are completed. As the tools are of different sizes they can by this arrangement each be run at the proper speed. So far as possible the tools used are made adjustable, and are examined by a workman whose business it is to attend to them, at regular intervals, and when necessary adjustments are made or new tools, always ready, are substituted. Gauges are used to prove the correctness of the work being done, and to adjust the tools by.

For all threads limit gauges are used, the difference in the size of a pair of these gauges being the greatest allowable difference in the sizes of parts. Thus for any hole tapped there are a pair of accurately made screw plugs, one of which must screw into the tapped hole while the other will not. Gauges on the same general principle preserve sizes in all the parts, making it possible to duplicate pieces, and doing away with any question of fitting in assembling the parts.

For inside threading lathe tools those similar to the one shown by the sketch are used. As will be seen this consists of a disk of steel, *a*, usually long enough for two full threads, and of a diameter to some extent proportioned to the size of the hole to be threaded. This disk is made to screw to a round shank, *b*, and cut the required lead and a notch cut in the periphery, as at *c*, to provide a cutting edge and clearance for chips. The advantages of this kind of tool are that the thread can be accurately formed in the lathe, and once cut will be correct until the entire disk is worn out. No time is required to grind to shape, and the possi-



bility of mistakes in grinding is avoided. All the grinding is done on the cutting edge, at *c*, which is ground away as required until substantially nothing is left of the threads around the disk. The round shank is held in the tool-post between two blocks, each hollowed out on one side to fit it, and as the disk is ground away, in sharpening, it is only necessary to turn the shank around to bring the cutting points to the right height. The tool is very cheaply and easily made, has large lasting qualities, requires a minimum expenditure of time in grinding and if ground to cut at all and set to the right height with the round shank in line with the lathe will cut a thread of the correct shape. Outside thread tools are made on the same principle, the disk in this case usually being bolted to the side and near the end of a rectangular shank, a countersink headbolt being used. It should be observed in making and using these tools that for an outside right-hand tool the thread on the disk should be cut left-handed, but for an inside right-handed thread it should be cut right-handed. Where it is necessary to cut up close to a shoulder the front side of the disk is recessed from the center out nearly to the thread, and the part outside the recess worked off in the lathe to the angle of the pitch.

We were shown by Mr. Barney, the foreman of the works, a lathe at work cutting short threads, in which for lack of time and room the tool is not withdrawn from the thread in running back. Of course this is only a question of no back-lash, which might perhaps be looked for in a new lathe, but this was an old Putnam lathe, that had seen a good many years' service.

The system by which the work of making inspirators is carried on at these works is very complete from the time the patterns go into the foundry till the finished inspirator leaves the testing room, which it is not allowed to do until its working qualities are thoroughly tested. The greatest care is used in the selection and mixing of the metal for casting, the chips made in the works not being used in the foundry for fear of the accidental presence of pieces of iron or steel.

There is another story afloat about a buzz-saw encountering a bomb-shell that was imbedded in a log. This time the incident happened in New Orleans. Before it was in South Carolina. The forests of the South were well peppered with shot and shell during the late unpleasantness, and it would not be surprising if embedded shells should use up several saws. But when once one of these stories is started there is no telling how it will multiply.—*Northwestern Lumberman.*

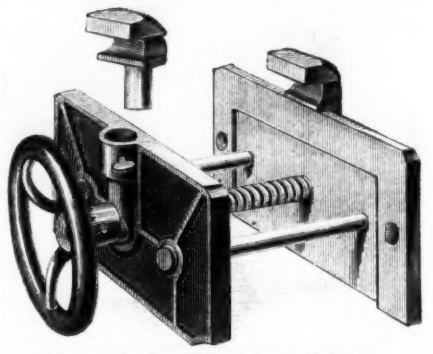
Car-Builders' Club.

The first meeting for the season of this club was held in the rooms, 113 Liberty street, New York, on the evening of October 18th. Mr. Garey, president of the club, occupied the chair, and there were about a dozen members present. The business was of a preliminary character, and consisted principally of making arrangements for the succeeding meetings of the club for the coming season. The following subjects were chosen for investigation and discussion: November meeting—The quality of material used in the construction and maintenance of railroad cars. December—The carrying capacity of freight cars. January—Car wheels and axles. February—The benefits to be derived by railroad and car manufacturing companies from the adoption of a standard freight car of the various classes. March—Whether it would be practicable or economical to light cars with electricity or gas; also, an inquiry into improved heating and ventilation.

Bellamy's Pattern-Makers' Vise and Clamp.

This vise, although especially made for pattern-makers and wood-workers' use, can be used for other purposes. The two jaws can be used as an ordinary vise, or can be removed, while the clamps alone are required. The back jaw sits rigidly in the socket, but the front jaw can be left to swivel for tapered work, or can be made fast in any position by the thumb-screw. The actuating screw can be quickly moved by the heavy hand-wheel. The vise can be attached to any bench by two screws. The jaws open six inches.

The New York agent for the sale of this vise is H. F. Sise, 100 Chambers street.



BELLAMY'S PATTERN MAKERS' VISE.

Whipping the Last Duck in the Machine Shop.

BY FRANK H. RICHARDS.

Books of travel tell us how in his native land the enterprising Chinaman lives in a boat and keeps great flocks of ducks, and how he trains those ducks to promptly return to their home at the proper time by always whipping the last duck. This, it seems to me, is a practice of wider application, and the method of the ingenious Celestial might even find its use in the modern machine shop. I have faith in the continued progress of the mechanic arts. The free discussion of methods and practice cannot but be of value to all concerned, and improvement is visible everywhere. In calling attention to our generally loose practice of tapping holes in machine work I imagine I am pointing out what is just now the last duck, and it is to be hoped that the animal will receive such a castigation—not at my hands alone—that we may then be able to turn our attention to the next laggard. If there is anything more careless and disgraceful, measured by the precision of our workmanship in many other particulars, than the common practice of tapping holes by hand I do not happen to think what it is. No one needs to be told that bolt-heads and nuts should come down flat and true upon the surfaces they are to bind. Everyone knows that every hole should be tapped straight and true, and only straight and true from the beginning. Only thus can a perfect hole be secured. You can't start a parallel tap—which we commonly use—you can't start it crooked and straighten it up about the time the hole is half tapped and have a perfectly tapped hole when finished any more than you can start to saw off a piece too short and have it the right length when done. We try it often enough though. The usual way to tap a hole is to start in the tap haphazard, just turn it around and bear on, and after it gets a good hold and begins to "draw" we stand off to the north and take a good squint at it, then we squint at it from the east, and then we give it a turn or two, crowding it over hard to the southwest at the same time, that being the direction we think it probably ought to go. Then we stop and squint and guess again, and when we get it near the "pretty good" or the "that'll do" angle we run the tap down to the depth required with a glowing sense of relief. We are truthful enough never to use the word "true" or "right" in characterization of work done in this way. We tap holes as we govern our steam engines; we let them go wrong first and then try to correct them and so maintain a kind of respectable average, and in the case of the steam engine this practice is justified by the fact that as yet—or I have not heard of it—human ingenuity has not devised anything better, but in the matter of tapping holes the simplest mechanic could readily devise a means of guiding a tap truly, but it is seldom done.

In the autobiography of James Nasmyth, lately published, he enumerates the important mechanical inventions of his life, and among them is a device for guiding a tap in hand tapping. It is simply a sleeve fitting the shank of the tap with a base at right angles to it to be clamped to the piece to be tapped. The ingenuity displayed in the device is trifling, but his recognition of the necessity and value of correct workmanship and his insistance upon it, mark his high status as a mechanic.

The life of Nasmyth, to which I have alluded, is a work of surpassing interest, and one which every young mechanic should own and read. Here is a little passage that occurs early in the book:—"The truth is that the eyes and the fingers—the bare fingers—are the two principal inlets to sound practical instruction. They are the chief sources of trustworthy knowledge in all the materials and operations which the engineer has to do with. No *book* knowledge can avail for that purpose. The nature and properties of the materials must come in through the finger ends; hence I have no faith in young engineers who are addicted to wearing gloves. Gloves, especially kid gloves, are perfect non-conductors of technical knowledge."

Tapping and drilling have not progressed together. I saw the machine shop years before I saw a drill-press. Drilling was mostly by hand, and at one time I lent the operation considerable of my valuable assistance. Since then drilling has been promoted, and we may say it is now always done by machine. Tapping is still mostly done in "the good old way." Generally speaking the best time that will ever be found to tap a hole is when you drill it. We often take great pains to true up and clamp a piece for drilling. The same labor of preparation will have a double value if we also tap the piece while in this position. When mechanics get their eyes open the drilling machine will be put in the market as a drilling and tapping machine. The design of the modern drill-press with its balanced spindle and quick return movement, the release of the feed leaving the spindle free to follow the lead of the tap, fits it completely for tapping purposes. Provide sockets for holding the taps, and a backing belt and shipper, and the arrangement is complete. I have put a backing belt upon our best drill press, and it is a great success and adds largely to our comfort. Taps may probably be driven with safety by a good and true drill chuck. If some flat places are ground upon the shank to match the jaws of the chuck it will make it much safer. Of course these flats should be true—an emery grinder would do it efficiently.

There is room in the market for a two-spindle drill, or a new drilling and tapping machine. I would have one spindle run fast for drilling, and the other slow for tapping; thus there would be no time lost in changing drill and tap. The two spindles should be equi-distant from the center post, so that when a hole was drilled the table could be swung around to bring it under the other spindle for tapping. These two spindles could be driven by an intermediate shaft running at a speed between that of the two spindles, gearing up to the one and gearing down to the other. Thus all the speeds of the back geared drill would be obtained without the back gears.

I doubt not there are others who could say something upon the tapping question, and I think they would find a good audience in the readers of the AMERICAN MACHINIST. I would certainly like to know how many are traveling in the newer and better way. It may be that the true and economical and correct practice is wider diffused than I am aware of. I certainly walked through the large establishment of one of our most respectable machine tool builders, not long since, and I saw hand-tapping in progress, and I saw no other mode. A center in the drill spindle guiding the top of the tap is often a convenience and will result in true work. The loveliest tapped holes I ever encountered I saw in one of Prof. Sweet's engines. The holes were enlarged at the bottom, and the thread was just perfect and lovely. We can't all afford that, but we can make our work true and strong, if not quite so pretty.

Compound locomotives appear to gain favor in Europe, and the number in use is steadily increasing. *Engineering* has recently published engravings and details of a new locomotive of this type, which was exhibited in the Amsterdam Exhibition. This locomotive was built by Mr. Schichan of Elbing, and is altogether of a different design from the Webb compound locomotive, lately illustrated in our columns. The Schichan engine has some resemblance to the ordinary American locomotive, and is designed with two cylinders one for high pressure the other for low pressure steam, both being located outside the frames. The boiler carries steam of 160 pounds pressure. It is claimed that engines of this class save fifteen per cent. of the fuel used by other locomotives to do the same amount of work.

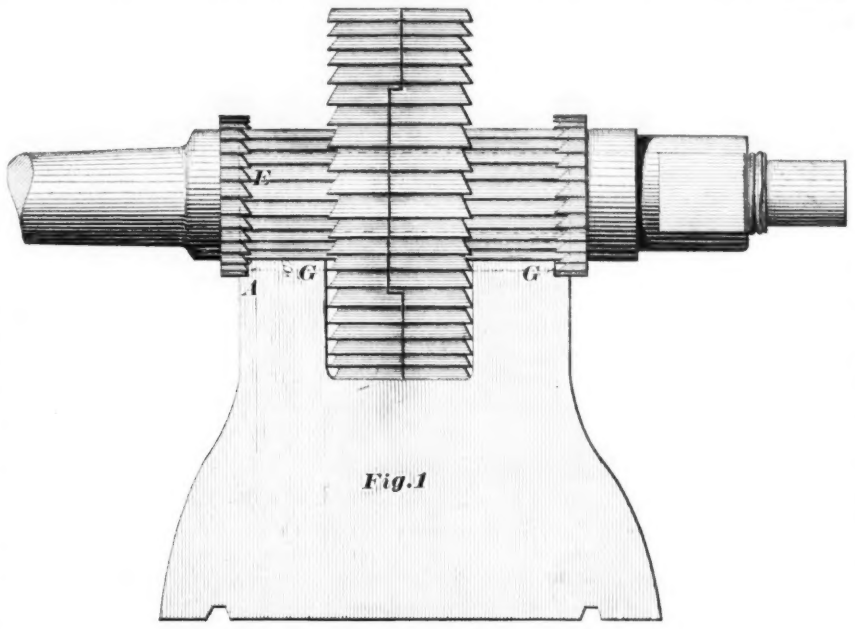


Fig. 1

The Milling Machine—Its Construction and Uses.

EIGHTH PAPER.

BY JOHN J. GRANT.

Milling with a number of cutters together on the same arbor is called gang milling, and constitutes a large amount of the work done by the milling machine in gun and sewing machine factories. In this class of work the milling machine of the present day is seen to its best advantage, the amount of work accomplished in comparison with the planer being in some cases as high as 100 to 1 in favor of the milling machine. The difficulty of making and keeping in order the milling cutters for this class of work is, of course, greater than in the instance of tools for common slab milling, yet by this one process more than any other has it been possible to produce such work as guns, sewing machines, and other like machinery, cheaply. And when it is carried further, and milling machines are made suitable to mill in the same manner heavy pieces of machinery, such as lathe beds, heads, saddles, and in fact nearly every part of a machine tool which is usually done on a planer, we shall come nearer to being able to compete in price with foreign makers of such tools, and at the same time keep the quality of the tools where it now is. The sum total of all the operations that have to be performed either by the planer or milling machine, on a lathe, for instance, would not cost more than one-third as much if done on the milling machine as it now costs for planing, including in both cases keeping tools in order. Such operations would necessitate the using of large numbers of gang cutters, and the accompanying drawings will, I think, give the best forms of the same as made by tool-makers in modern equipped shops.

Fig. 1 shows a gang of cutters milling out the jaws of a lathe head, where the boxes are fitted in, the jaws having a lock for the cap to tie them together. This operation requires a gang of six cutters, which are made as follows: The outside cutters are of sufficient width to cover the casting at *A*. These cutters are turned under to dotted lines, and cut on both face and periphery. The two next the outside ones are straight cutters of a less diameter, equal to twice the distance at *C*. They should be for this size job and cutter $\frac{1}{8}$" less in length than the distance to be milled, to allow for grinding and adjustment. The space between them, at *E*, should be packed with paper washers. An exceedingly fine adjustment can be obtained in this way by using tissue paper. These two cutters are cut on the periphery only. The center cutter of the gang is made in two parts, locked together in the manner of an old-fashioned clutch coupling. This allows the cutter to be spread apart for adjustment, and at the same time cut the entire surface. The cutters for milling the under side of the caps will require only four in the gang, the center one locked together as in the other gang and occupying the distance from *G* to *G*, and cut on the face only. The two outside ones should be narrow, and of a diameter less than the center ones equal to twice the depth at *C*, and cut on the face and periphery.

In making cutters that are locked together the best plan is to cut the faces, like a clutch coupling, with only four spaces or locks on cutters up to about 4" diameter, and five or six on cutters above that size. This locking together should be done before the teeth are cut on the periphery, paying no attention to where the teeth may come, but cutting them through the lock in any position.

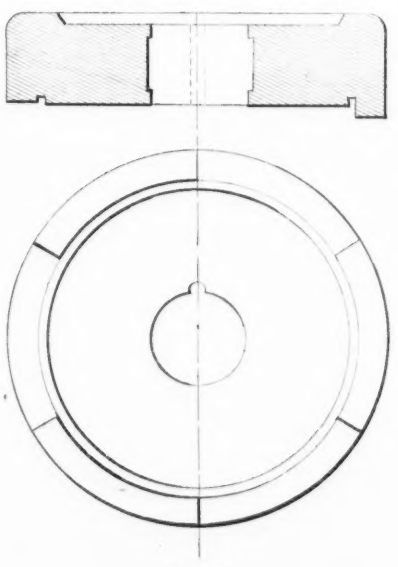


FIG. 2.

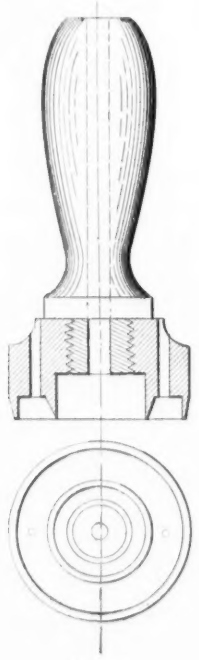


FIG. 3.

Fig. 2 shows (half size) one-half of the blank for such a cutter, the other half being a duplicate of this. The engraving shows how they are locked together. This plan I think greatly superior to the plan of cutting as many teeth in the lock as there are teeth in the cutter, as the teeth in the locked position are as strong as any other part of the cutter, with the advantage of not requiring nearly the amount of labor to cut them, and considerable less liability of cracking in the process of hardening.

Finishing cutters should never be taken off the arbors except to grind, as the cost of an arbor is insignificant when compared with the cost of continually readjusting the cutters. When once set the cutters will mill, in many cases, hundreds, even thousands of pieces before wearing out of gauge. The roughing cutters, of course, may have to be ground a dozen times during the same period.

A box containing paper washers, cut from good, even-calendered paper of various thicknesses, will be found invaluable around a milling machine. They can be punched out by the punch shown half size in Fig. 3, using a block of hard, close-grained wood, set endwise to punch against.

These examples will show to those not familiar with this class of work the manner of making cutters for gang milling. With suitable machinery and tools, it can be carried to any extent as to dimensions of work. Any one, even without experience with the class of work shown and described, will see at a glance that the planer has no show whatever in either the amount of work turned off or the quality. The amount in the example shown is at least five to one in favor of the milling machine, and the quality is so much better that it hardly admits of comparison, the last head taken off the machine being an exact duplicate of others taken off before it.

In my next article I will give an example of face milling with a cutter taking a roughing and finishing cut at one operation. This can only be done in the larger class of milling—that is, to good advantage—and will not do where extreme accuracy is required; but for a great many places, such as facing off the ends of columns, beams, bridge girders, and thousands of other places, work can be done very rapidly that will stand a fair trial as to accuracy.

Mr. B. Samuelson, M. P., an eminent Englishman, a scientist, a man of letters and chairman of the Royal Commission on Technical Education, speaking lately before the Iron and Steel Institute of which he is president, made the assertion that each family in the United Kingdom would suffer an annual loss of about $64, should anything happen to deprive Great Britain of the business followed as artificers and carriers for other nations. As a means of maintaining British eminence in art and commerce, he strongly urged improved technical and industrial training for the men who were destined to prepare the products on which the country's prosperity depended.

The Franklin Institute will make a fine display of electrical appliances at the Electrical Exhibition, to be held in Philadelphia next autumn. The work of organizing committees is now going on, plans are being proposed, etc. A special building will be erected for the exhibition, and, as Philadelphia people have the reputation of knowing how to manage such an affair, we expect they will make that exhibition a success. Amongst other things that ought to be definitely settled is the actual cost of electric lighting on a basis that will admit of intelligible comparison with other systems of lighting, and if the Institute will do this they will confer a favor on many who are interested.

Dr. Williams, of the Baldwin Locomotive Works, who has been in Europe lately on a combined business and pleasure trip, returned on October 13th by the North German Lloyd steamer Werra. While in London, Dr. Williams contracted to build thirty locomotives for railroads in the Argentine Republic. English parties made a vigorous effort to obtain this order, but the agents were instructed to get American locomotives if possible.

The Ashland Coal and Iron Railway Company's shops at Ashland, Ky., have put in a busy season. From Mr. Roberts, the master mechanic, we learn that the shops have been entirely remodelled, and a new engine and boiler have been put in. They do the machine work for one blast furnace, two coal mines, two steamboats, besides their car and engine work. During the summer they built a new Mogul locomotive, all the work having been done by themselves except the casting of the cylinders. They have completed a new round-house, and are now contemplating the erection of an important addition to their machine shop.

Computation of Bevel Wheels.

BY HUGO BILGRAM.

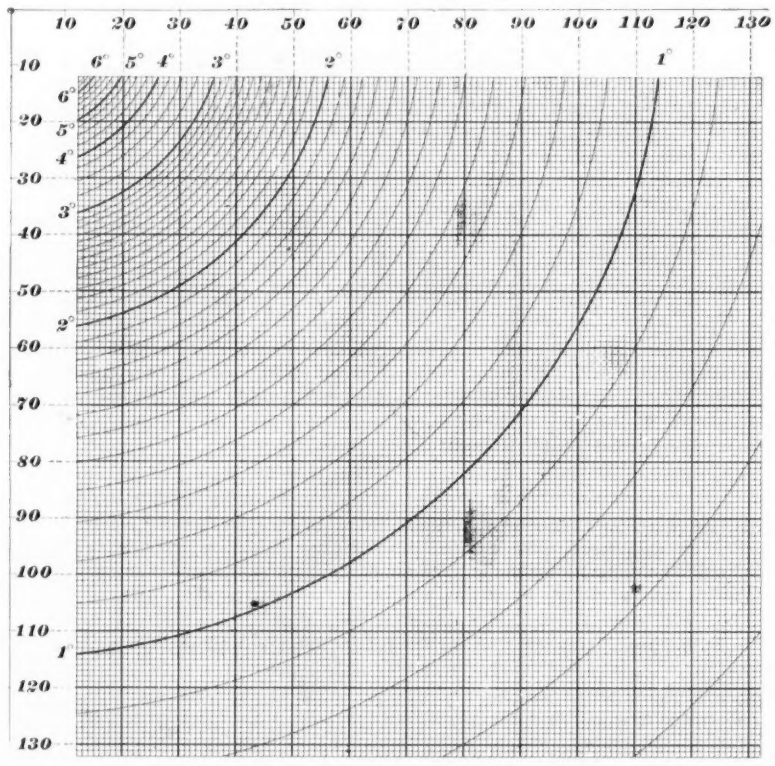
The computation and the making of bevel wheels is decidedly more intricate than that of spur wheels, because the producing lines, instead of being parallel, as in the latter, are convergent into a point—the apex of the bevel wheel. The pitch circles of the various sections, instead of forming a cylinder, are all located in a conical surface—the pitch cone—each section having a different diameter. Most of the dimensions should be measured by angles instead of linear lengths. Thus, the pitch cone is determined by its angle, and also the height of the teeth above, and the depths of the spaces below the pitch cone are properly angular measures. As the computations require the use of trigonometrical tables, which unfortunately are rather avoided by the majority of machinists, the most usual expedient for determining the elementary dimensions is to make a scale-drawing, and measuring by means of scale and protractor. Every experienced draughtsman, however, knows that in many instances the accuracy demanded of workmanship is much higher than that attainable on the drawing-board. It is a rare thing that an angle on a drawing, if measured by protractor, is determined any closer than by half-degrees, while an error of a few minutes often causes a machine to be far from first-class.

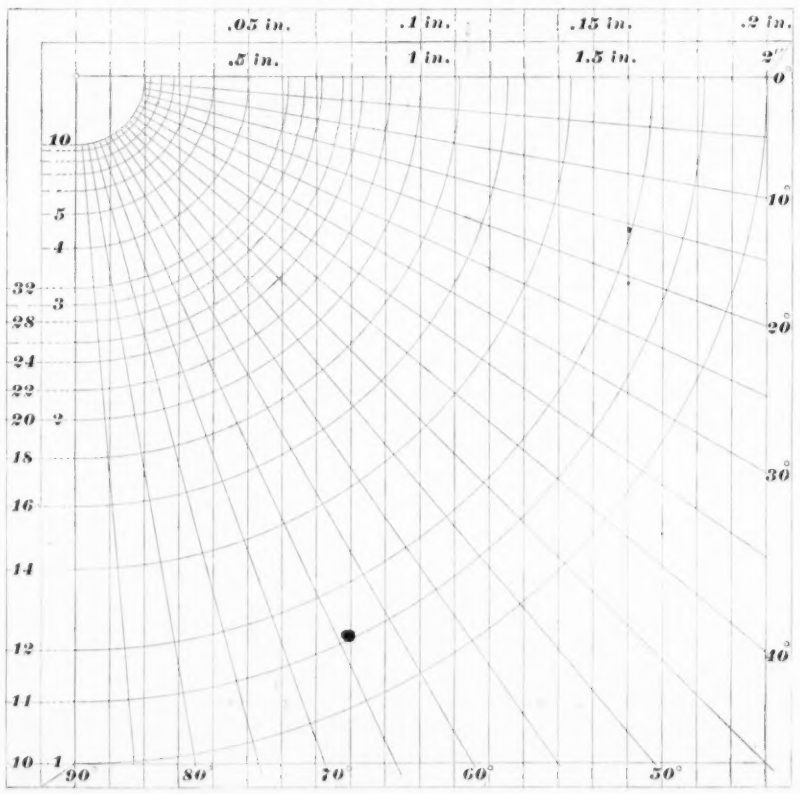
Even if the object were not the attainment of greater accuracy, the method suggested in the following possesses value in requiring less time and skill.

The data required to make a bevel wheel are, the number of teeth, the largest pitch-diameter, the angle of pitch cone, length of face, the angles of the height of teeth and the depth of spaces, and the outside diameter of the blank. By far the most bevel wheels are made in pairs forming right angles, and for this reason the following will be confined to such:

The Pitch.—In one sense the pitch as well as the radius of the pitch circle in bevel wheels are more properly expressed in angular than in linear measure, notwithstanding the usual practice of giving the dimensions of bevel wheels by the largest pitch diameter and the corresponding circumferential or diametral pitch. It is a fact that while two spur wheels of equal pitch (provided they are both of the same system of interchangeable gearing curves) will invariably gear properly, the same is not necessarily the case with bevel wheels; for instance, a 24-teeth miter wheel 6″ diameter will never gear with a 28-teeth miter wheel 7″ diameter, although the diametral pitch in both is ¼″. On the other hand, bevel wheels with unequal pitches on their largest pitch diameters may be made to gear correctly; for instance, a 20-teeth miter 6″ diameter may gear with a 20-teeth miter 7″ diameter, provided the teeth of the latter are long enough and the apices of both wheels are made to coincide. The teeth of the 7″ wheel will, of course, project beyond those of the 6″ wheel on the outside. The reason is obvious. The linear pitch of spur wheels is the same in all cross-sections, but in bevel wheels it is constantly changing from the outside to the inside end of the teeth.

The pitch and the radius of the pitch-circle, when expressed in angular measure, are represented respectively by the angle formed by the lines connecting the centers of two adjacent teeth with the apex of the pitch cone, and by that formed by the surface of the pitch cone with the axis. If the angle is taken as a measure for the pitch, it can be said with certainty that any two bevel wheels of the same pitch will gear properly, provided the teeth of both wheels have the same distance from the apices in order that they should come in gear when the apices of both wheels are made to coincide.





But it is just in this respect that the largest pitch diameter and the linear pitch on the same come into play, as they limit or determine this very distance, and the writer is far from advocating any change in the present mode of giving the dimensions of bevel wheels, but simply intended to show the predominance of angular dimensions in bevel wheels.

If the number of teeth of a pair of bevel wheels are given, the respective angles of the pitch-cones may be found by making a scale drawing and measuring the angle carefully, or by means of trigonometrical tables, as the tangent of the angle of the pitch-cone is equal to the number of teeth of the wheel, divided by the number of teeth of its mate. The latter process admits of greater accuracy.

Height of Teeth.—The height of the teeth above, and the depth of the spaces below the pitch cone should invariably be measured by angles, and it is these angles that can very advantageously be found by diagrams instead of drawings or computations. In spur wheels the height above the pitch-line is usually made equal to the diametral pitch, and this proportion has been used as a basis for the construction of the diagram represented in Fig. 1. The horizontal and vertical lines represent the numbers of teeth of both wheels forming a right-angular pair, while the circular arcs show the respective angle representing the height of the teeth above the pitch cone.

If, for instance, the number of teeth of a pair of wheels are 36 and 50, the location of the point of intersection of the No. 36 horizontal with the No. 50 vertical line (or *vice versa*) in relation to the circular arcs is examined—this point is on the table between the 1° and 2° arcs, or taking the smaller divisions between the 1°50′ and 1°55′ (each of the smaller divisions representing 5 minutes), and it is easy to judge within one minute the intermediate division. The point in question is very nearly halfway between the two circular arcs, hence the angle sought is 1°52½′.

The curves of the diagram are true circular arcs drawn from the zero point of the straight-line division. If the radii are known any one can readily draw a diagram to larger scale, and the following table gives the points where those arcs intersect the 45° diagonal representing the miter wheels:

0°20′*	0°25′	0°30′	0°35′	0°40′	0.45′
243.09†	194.47	162.05	138.90	121.54	108.03
0°50′	0°55′	1°0′	1°5′	1°10′	1°15′
97.23	88.39	81.02	74.71	69.45	64.81
1°20′	1°25′	1°30′	1°35′	1°40′	1°45′
60.76	57.19	54.01	51.16	48.60	46.29
1°50′	1°55′	2°	2°5′	2°10′	2°15′
44.18	42.26	40.50	38.88	37.38	36.00
2°20′	2°25′	2°30′	2°35′	2°40′	2°45′
34.71	33.51	32.39	31.35	30.36	29.44
2°50′	2°55′	3°	3°5′	3°10′	3°15′
28.58	27.76	26.98	26.25	25.56	24.91
3°20′	3°25′	3°30′	3°35′	3°40′	3°45′
24.28	23.69	23.12	22.58	22.07	21.58
3°50′	3°55′	4°	4°5′	4°10′	4°15′
21.11	20.66	20.22	19.81	19.41	19.03
4°20′	4°25′	4°30′	4°35′	4°40′	4°45′
18.66	18.31	17.97	17.64	17.32	17.02
4°50′	4°55′	5°	5°5′	5°10′	5°15′
16.72	16.44	16.16	15.90	15.64	15.39
5°20′	5°25′	5°30′	5°35′	5°40′	5°45′
15.15	14.91	14.69	14.47	14.25	14.04
5°50′	5°55′	6°	6°15′	6°30′	6°45′
13.84	13.65	13.46	12.91	12.41	11.95

* Angles. † No. of teeth.

It may seem strange that there appear in this table fractional numbers of teeth, but if it is considered that the figures have reference to the diagram, Fig. 1, it is easy to see why this should be so. The writer found it convenient to make two tables, one from 12 to 200 teeth and another from 12 to 50 teeth, both occupying the same space, the latter being drawn to a larger scale.

The depth of the space below the pitch line is usually made a certain percentage greater than the height of the tooth above the pitch line, the difference representing the clearance. There is, however, hardly any need for a second table, as the depth is readily found by multiplying the height by the proper coefficient. The Pratt & Whitney Company, for instance, make the clearance one-eighth of the diametral pitch, hence the angle found by the diagram, Fig. 1, should be multiplied by 1.125 or $\frac{9}{8}$ to obtain the depth of the space below the pitch line. The Brown & Sharpe Manufacturing Company make the clearance one-tenth of the thickness of the tooth ($=\frac{1}{20}$ of the circumferential pitch. or $3 \cdot 1\frac{4\,1\,6}{2\,0}$ of the diametral pitch), and for their system the said depth is found by using the coefficient 1.15708 instead.

The total height of the tooth may be found by adding both angles, or by multiplying the angle found in the diagram by the coefficients 2.125, or 2.15708, or whatever the case may be.

As before mentioned, this diagram is correct only if the pair of wheels transmit at right angles, as most bevel wheels do. If, however, angle-wheels are in consideration, the diagram can be made available by complementing each wheel by drawing or calculation to a right-angular pair and determining the number of teeth which these imagined mates would have. These numbers will, in most cases, be fractional ones, which, however, the diagram readily admits.

Outside Diameter.—This dimension is not as easily found in bevel wheels as in spur wheels, owing to the inclined position of the teeth. In spur wheels the *modus operandi* consists in adding to the pitch diameter twice the diametral pitch. In bevel wheels this item must first be multiplied by the cosine of the angle of the pitch cone before its addition to the largest pitch diameter. But even for this operation a diagram may be used to advantage. Fig. 2 represents such a diagram, from which the dimension can be found which must be added to the pitch diameter in order to get the outside diameter of the bevel wheel, the pitch, and the angle of the pitch cone being given. The radial lines represent

the angle of the pitch cone, the circular arcs drawn from the vertical scale denote the pitch, and the vertical lines joining the upper horizontal scale represent the sought dimension in inches. Both scales are double, the corresponding ones being joined for identification. On the vertical scale of pitches the mark 2 should be at $\frac{1}{2}$, 3 at $\frac{1}{3}$, 4 at $\frac{1}{4}$, etc., of the length of the scale; 12 at $\frac{1}{12}$, 14 at $\frac{1}{14}$, 20 at $\frac{1}{20}$, 24 at $\frac{1}{24}$, etc. The horizontal scale represents 2 inches (enlarged scale), and each inch may be divided in 64ths, or, as Fig. 2 shows, in 10ths, and if the diagram should be made $12\frac{1}{2}$" square, each $\frac{1}{16}$" of any scale or rule would signify $\frac{1}{100}$ respectively $\frac{1}{1000}$ of an inch.

If, for instance, the outside diameter of a 48-teeth miter wheel, 12 pitch, were desired, the 12-pitch circle is followed up to where it intersects the 45° line. This point is located in relation to the upper scale at .118" (as 12-pitch is on the outer one of the vertical scale, the figure must be read on the upper horizontal scale). The pitch diameter being 4" the outside diameter of the bevel wheel blank should be 4.118 inches.

Another example will suffice to show the use of the diagram. The outside diameters of a pair of bevel wheels 16 and 32 teeth, 4 pitch, are found as follows: The angles of pitch cones are found to be 26°34′, and 63°26′, and following the 4-pitch circle to these angles, the figures found are .45 and .225, and as the pitch diameters are 4 and 8 inches, the outside diameters are 4.45 and 8.225 inches. When involute teeth are used, a modification of these outside diameters may be desirable in cases similar to this, owing to the well-known tendency of involute wheels to jam in pinions if the number of teeth in the latter is below 25 or 30. Various means may be employed to overcome this difficulty, but a discussion on this point would be beyond the intention of the present article.

If the diametral pitch of the largest pitch circle of a bevel wheel does not agree with any of those pitches which are marked on the diagram, a new suitable circle may be drawn, or else the pitch may be assumed to be =1 by using the largest circle of the diagram, but then the result must subsequently be multiplied by the actual diametral pitch.

In turning up a blank it is necessary to know the outside diameter, the angle of the ends, and the angle of the top of the teeth. The first of these two angles is equal to the complement of that of the pitch-cone, the latter equal to the sum of the angles of the pitch-cone, and the height of the teeth as found in diagram Fig. 1, but as the angles of compound slide-rests are usually measured from the right-angular position, the slide-rest should be adjusted, for turning the ends of the teeth to the angle of the pitch-cone, and for turning the top of the teeth to the complement of the afore named sum of angles.

Mr. Emil Wohlers, one of the firm of Nathan & Dreyfus, of New York, died in Vienna, Austria, Sept. 29. He was born in Lubeck, Germany, and at the time of his death was 37 years old. He was educated at the Polytechnic School at Hanover and started in business in Halle in an establishment engaged in manufacturing agricultural machinery and stationary engines. Afterward he was employed in a locomotive shop in Germany. Then he went to Vienna, where he met Mr. Friedmann, the inventor of the injector which bears his name, and took charge of his works and made many improvements in the steam jet apparatus, which were manufactured by Mr. Friedmann. He came to this country in 1874 and engaged with Messrs. Nathan & Dreyfus, who had then begun the manufacture of the Friedmann injector. He entered upon his duties with great energy and enthusiasm, and made many improvements in the instruments manufactured by the firm. His ability led his employers to give him an interest in the business nearly two years ago. He made many friends among those with whom he was brought into contact, and his death will be sincerely regretted by a wide circle of friends. He leaves a wife and two children. —*Railroad Gazette.*

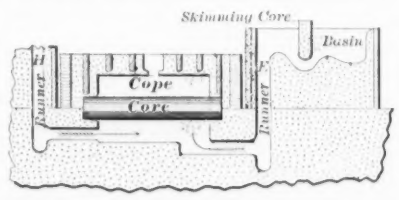
Casting Finished Work Horizontally.

BY THOS. D. WEST.

In a former article I described the casting of a hydraulic hoist in dry sand. In this the manner of making a longer one in green sand will be described. It may be asked why, if a casting about twenty-three feet long could be made in green sand, one about 14½ feet long could not be made in the same way? It would be unreasonable to expect that such castings will be as perfect cast horizontally in green sand as if they were cast vertically in dry sand. The longest one would have been cast vertically had there been a foundry near by that had the facilities for doing it. The casting had to be made, and as no one would cast it vertically, some one must do it horizontally. The Cuyahoga Works was selected to do the job. The castings, when finished up, presented a very creditable appearance for green sand work.

The upper cut shows the dimensions of the casting, the dotted lines representing stock allowed for holding dirt and for finishing. The length of casting, as taken out of foundry was twenty-four feet two inches, eighteen inches of which, as shown at the gate end, was added as stock for holding dirt, and was cut off in finishing. The rib (31) was cast on as a dirt riser, and was also cut off. No. 30 was a flange used to assist in the moulding, and as it was a good thing to attach the pouring gate to, it was left and cast as shown. The reason for pouring the casting entirely from the end that was not to be finished was that such gated castings will be the dirtiest at the gate end; in fact, such gates, as a general thing, do not distribute dirt only in the section to which they are attached. If one were to cast an open sand block having such an under gate, he would most likely see nearly all the dirt collected in a body directly over the gate. The action of the molten metal forms a whirlpool, as it were, over the gate, thereby preventing the dirt from flowing away with the metal.

To further discuss the important question of properly gating moulds, the small cut is



presented. At *E* is shown the under gate, similar to the one in the large engraving. The arrow represents the flow of metal. The core shown has prevented portions of the dirt from rising up to the top of the cope. At *H* is shown a style of gating that will not confine the dirt to the gate portion of the casting; and, in fact, to correctly foretell where the greater portion of the dirt would be collected is a difficult task. Such gates are distributors of dirt, while such as the one at *E* confine it. This is a point that must be considered in the gating of moulds, as it has much to do with providing that the gated end of a casting shall catch and hold the gate dirt. The gated end of such castings *should* contain about all of the gate's impurities. But I think the interested reader will plainly see that this will depend greatly upon the style of gate used. Because it is the gated end, it will not be the cleanest or dirtiest.

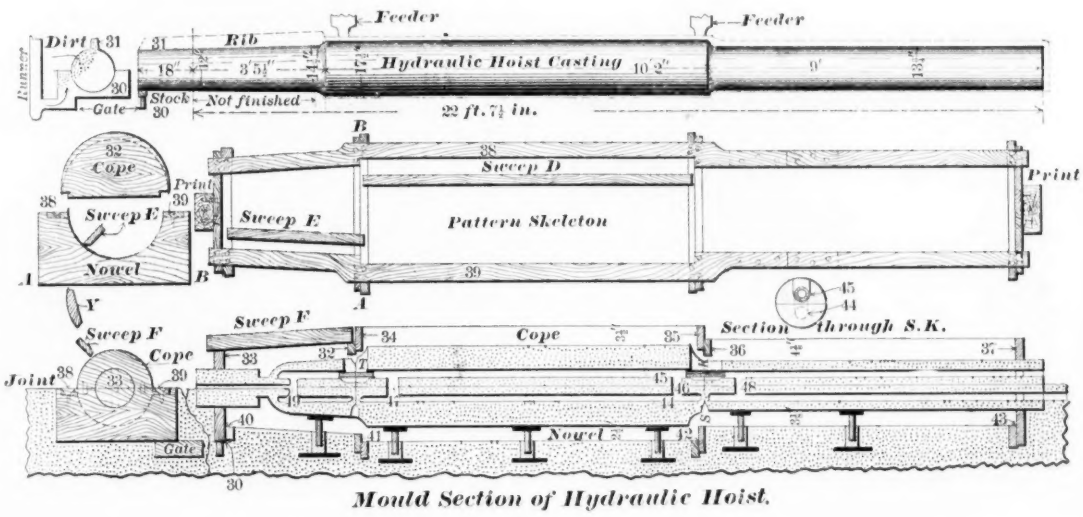
Another point that may be noticed is the destructive qualities of the two styles of gates shown. Under gates, as at *E*, are, as a general thing, the easiest upon a mould, as the metal in flowing is not allowed to run over the mould's surface, as it would from gate *H*. Surface scabbing or mould cutting is very liable to occur with the last-named gate, because of the friction of metal upon the mould. Under gates, as at *E*, fill up a mould with very little surface friction, and are, as a general thing, the best to adopt.

When under or side gates are used, so as to be independent of a cope, thereby not allowing skimming gates in the cope, the basin with the skimming core is advantageous, as it prevents the skimmings from passing into the mould. In fact, for all clean work, combining such skimming basins with direct runners will always be a great assistance.

As there was only a few of these castings to make, the company did not wish to go to expense of a complete pattern, so the skeleton frame was used. In making the mould, the frame was bedded in level and true, and after being rammed up and the joint made, the cope form of pattern was made by setting on circular pieces, as shown at Figs. 33, 32, 34, 35, 36 and 37. Between these sand was firmly rammed, the whole being struck off with sweeps, as seen at *F*. Paper being put over the sand to form a joint, the cope was put on and rammed up. After being lifted off, the false sand pattern was then shoveled away, and the nowel part of the mould formed by strikes or sweeps, *E* and *D*. After the sweeping, the long sides of the frame, 38 and 39, were unscrewed and drawn off. The open space thereby left was then filled up with sand, the circle of the mould being followed up by using a piece about two feet long, and the circle of mould, as at *Y*. This made the mould's circle complete up to the joint. The sweep guides, 40, 41, 42 and 43, were then drawn and their space filled up, after which the mould was finished. The metal around the core was one inch thicker in the cope than in the nowel, the inch being for a riser or space for holding the dirt and impurities of the metal. The extra stock was turned off in finishing the casting. This extra thickness was allowed for in the making of the circular cope guides, as represented by 32, the outside line being elliptical, while the dotted line represents a true circle of the required finished size.

Another point of some interest is that of coring long moulds, where, through lack of oven or shop facilities, the center core must be made in three separate lengths. The difficulty attending the splicing of such cores is in getting off the middle core vent. The most reliable way I know of to carry off such core vents is the one shown. When making the cores, vent rods, 44 and 45, are rammed up in about the center of each half. Then, when pasting the cores together, a connection, 46, 47, 48 and 49, is made. (With this job 48 is not really necessary, as the upper vent is sufficient to take care of what is required to be carried off.) Where the conections are there must be a reliable close joint, for if any metal should get in you might expect a blow-up. In making the vents in the center of the halves instead of at the joint, as is generally done, there is less risk; for if iron does find its way to the joint it can do no harm, the parts where the connections are, of course, being excepted.

When the cores are butted together in the mould, two pieces of $\frac{3}{4}$" gas tubes, *T* and *K*, are placed, the cavity for their insertion being cut out in making the cores. An end view of the cavity and tube is shown at section through *S*, *K*. After the tube is inserted about one inch in each vent hole, the rest of the cavity is carefully filled up with new moulding sand, which, if wet with beer, is all the better, as it will air-dry more solid than if the sand is dampened with water. The tubes are better for having a few $\frac{1}{4}$" holes drilled in them, as this will allow any gas in the green sand used to escape. Before smoothing off the green sand, it should be vented down to the tubes with a fine wire; the holes at the surface being well closed, the green sand is then oiled over. The balance of the work is treated as is commonly done. The cut of pattern, skeleton and mould, is shown wider than its proportion to length. This is done to give a better chance for figures, etc. The cut of the casting is proportionately shown.



Mould Section of Hydraulic Hoist.

The desire to decrease the danger from fast-revolving emery wheels has brought out a new device patented by Heman S. Luens, Chester, Mass. It is the combination with the emery wheel and its arbor of a series of compression shells, adapted to be clamped against the opposite sides of the wheel, their object being to bear part of the centrifugal tension.

A good field for business is opening in Mexico for machinery of all kinds. Every mile of railroad opened accelerates the demand for agricultural and mining machinery to harmonize with the improved condition of transportation. Makers of steam pumps will soon be called on to provide means for draining valuable mines of water. Many Mexican mines rich in ores beyond computation are drowned out for want of proper means of keeping down the water. They are now in about the position of many Cornish mines when Watt began to introduce the steam pumping engine. The common method employed by the natives to raise water from the mines, is by buckets of raw hide worked on a primitive ladder of notched poles.

It is reliably stated that the South Penn Railroad Co. is in condition to build the road from Harrisburg to Pittsburgh, Pa. The capital stock, which was placed at fifteen millions of dollars, was all taken by eighteen men.

In a paper read at the Cleveland meeting of the Society of Mechanical Engineers, by Howell Green, on "Pumping Machinery in the Anthracite Regions," he asserted that the average pumping duty got from 100 pounds of coal ran between 10,000,000 and 20,000,000 foot-pounds. This is very wasteful, and, were it not that the work is done amidst the fuel, where the expenditure is not noticed, it would not be tolerated. Good pumping engines yield a duty of 60,000,000 to 100,000,000 foot-pounds to 100 pounds of coal consumed.

The New England Cotton Manufacturers' Association hold their semi-annual meeting in Boston, beginning Wednesday, October 31st. The main subject for discussion will be, "How to improve the running of cotton mills during dog-days." As low water may generally be looked for in the dog-days, we suggest that putting in good steam engines would improve the running of many cotton mills during that period. We do not think mill-owners experience any difficulty by reason of their operatives' absence at Saratoga or Long Branch during dog-days.

Edward Atkinson has been invited to address the Association upon the difference between American and English processes in cotton manufacture, as observed by him during his recent short stay in Yorkshire and Lancashire. This subject, treated by Mr. Atkinson, promises to be of extensive public interest.

The steamship City of Rome has no less than twenty-four independent engines on board for doing the necessary work about the ship. A fine set of engines are used for compressing air for refrigerating the part of the vessel where fresh meat is carried. On the last homeward trip for this season she carries $15,000 worth of fresh meat, which is kept in good order by the refrigerated air.

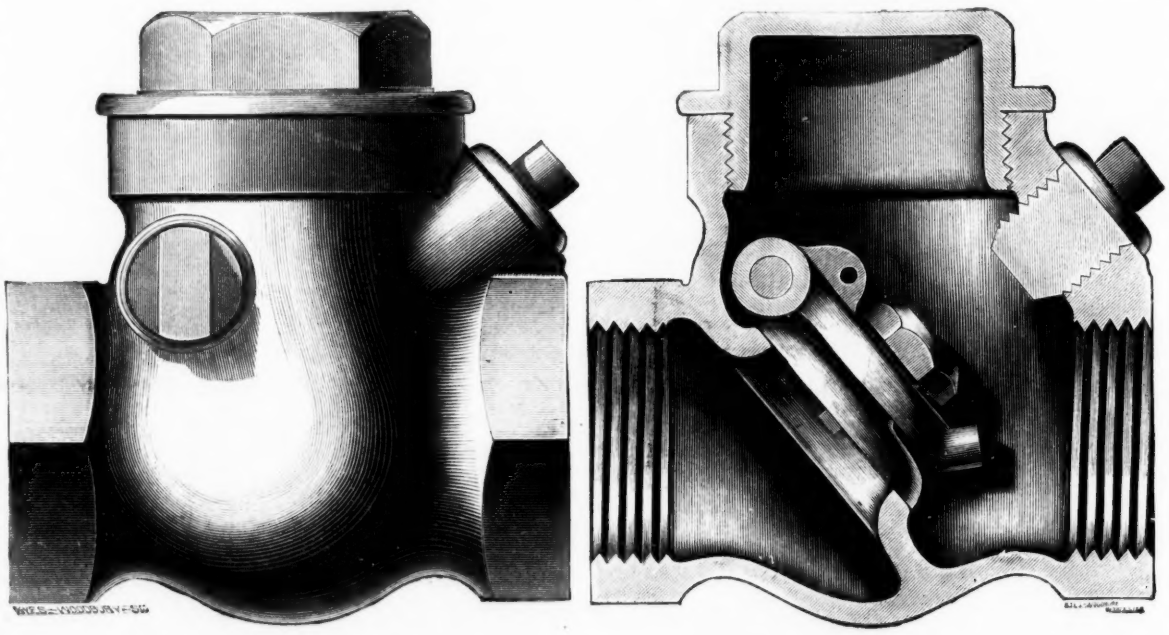
A patent has been secured for a new button fastener, and we have no doubt but the device is going to confer a priceless blessing upon bachelordom. It consists in passing the prongs of the fastener through the material and upsetting the ends at the other side. This may be all right for a patent, but it has a strong resemblance to an old bachelor practice we remember of manipulating a pin to take the place of a delinquent button.

Pratt's Straightway Swinging Check Valve.

The engravings show this valve, in perspective and section, as at present constructed. It is made to occupy the same space as an ordinary check valve, and the arrangements for coming at the disk and seat are quite complete. The small screw plug shown at the front forms a bearing for one end of the pin upon which the clapper swivels. By unscrewing this plug the pin may be removed; then, by removing the cap, the valve can be taken out; if hot, using a bent wire hooked into the hole provided for the purpose. If from the presence of dirt or foreign matter the valve leaks, the small plug at the end can be removed, and by inserting a screw-driver through the hole and in a slot in the head, the disk can be revolved on the seat to clean the surfaces; or, if necessary, the valve can be reground at any time in a similar manner, and without further disconnections, except removing the cap. The valve disk is not in a condition of rigidity with the clapper, the connection being such that it may not only be revolved, but also such as to allow the motion necessary to permit it to accommodate itself to the seat by motion in any direction. A direct and unobstructed passage is provided by the lift of the valve, the area of passage being equal to that of the connecting pipes.

The various parts are made interchangeable, and can be renewed without trouble. When desired, the valve disks are fitted with removable rings, made of material suited to special uses for which the check may be required. The valve may be used either vertically or horizontally, the seat being at an angle that provides for the seating of the disk by gravity in either position, while there is no stem or other line guide to cause it to stick.

A. Aller, 109 Liberty street, is the New York agent.



PRATT'S STRAIGHTWAY SWINGING CHECK VALVE.

Accident to the Engines of S. S. Oregon.

When the engineers came to examine the engines of the Oregon, when in the port of New York last week, they discovered that the spider of the piston belonging to the forward low-pressure cylinder was cracked, and also that there was a crack in the casting of the cylinder. The defect was so serious that the officers determined to put the cylinder out of service on the homeward voyage. They took the piston off the rod and disconnected the valve, centering it on the seat to exclude steam from that cylinder. Their reason for not disconnecting the low-pressure connecting rod at the crank was that the air-pump is worked from the cross-head. By merely taking the piston off the rod they were able to let the cross-head operate the air-pump as usual.

The officers of the ship kept this matter very quiet. They guarded the engine-room to prevent access of strangers, who might have let the argus-eyed reporters of the daily press into the secret. We received intelligence of the accident three days before the vessel sailed, and a representative of the AMERICAN MACHINIST called on the chief engineer and asked for detailed particulars, but the desired information was refused. The above particulars, however, were obtained from a reliable source, and cover the more important features of the accident.

LETTERS FROM PRACTICAL MEN.

Boiler Explosions—Water Gauges and Low-Water Alarms—Mathematics and Common Sense.

Editor American Machinist:

Will you allow me a word on the interesting subject of boiler explosions? In your issue of October 20, J. E. McConnell expresses some views on this subject with which a practical experience of 23 years leads me to disagree. Unlike your correspondent, I have witnessed five boiler explosions, and, I believe, prevented the sixth. I have had charge of the very best of steel boilers and some very poor and old iron boilers; have tested them by all the means commonly practiced, and the conclusion I long since came to is that with sufficient water in an old boiler an *explosion* cannot take place, for the sufficient reason that the weakest spot will give way; in other words, it will *blow out*, but will not *blow up*. I have yet to see the first instance of an old and weak boiler with plenty of water leaving its setting. An explosion may take place in the case of a sound boiler and overpressure, or in the case of any boiler if the water gets out, permitting the formation of gas and heating the sheets red-hot, then pumping in even so little as a pint of water. I think 100 per cent. would be nearer the number of explosions caused by low water.

Low water generally comes from neglect to use the try-cocks, depending on the water-glass, which ought to be taken off every boiler in use. Water-glasses are not reliable enough for the class of men that are employed to run boilers. Low-water alarms are also unreliable, the only safety being in the use of the try-cocks. No matter how ignorant the man is, with the cock open and his hand under it he can tell whether it is wet or dry. If it is wet he knows there is water, and if dry he may, after a time, be taught to haul the fire.

But a great many times the fault is more with the employer than with the ignorant man in charge of the boiler. The instances are not rare in which a college-crammed chap, with six months' experience in a machine shop, is employed as chief engineer. He leaves strict orders in case of low water that he must be called before anything is done. He may perhaps be found in from one to four hours, unless sooner brought around by the noise of an explosion. This chief engineer is good on figures and will figure out the trouble, making it plain from the capacity of the pump that if the fireman had kept it on all the time, as he told him to do, the boiler would not have got dry before he came back.

What is needed to prevent boiler explosions is less figuring and more of the knowledge gained by practical experience—less of mathematics and more of common sense.

Ontario. JOHN SILER.

Boiler Inspection in Texas.

Editor American Machinist:

In your issue of October 6, "Engineer," in his views on boiler explosions, speaks of boiler inspection as being rather loose. In this State we are not troubled much with boiler inspection, loose or otherwise. In the city of Galveston I was employed by one firm over two years, having charge of two boilers. One of those boilers was old and was never inspected, and the other a new one I put up and run for more than two years, and it was never inspected while I had charge of it. It had a certificate of inspection when made, which evidently must last as long as the boiler does.

About four years ago I had charge of a boiler and engine in Cuero, Texas. It was a horizontal boiler, locomotive type, about 40-horse power. About a month after taking charge of this boiler, I heard a suspicious noise as of escaping steam in the fire-box. On opening the door I saw steam escaping near one of the tubes. The steam pressure at the time was sixty pounds. I notified the superintendent, but he said it would be impossible to stop, and inquired if I could not run about two weeks. I replied that I would risk it with twenty-five pounds pressure, if he would.

The two weeks passed and nothing was said about stopping for repairs, the boiler leaking about two barrels of water per day. Another week passed and I left. That boiler was not repaired until it was impossible to keep a fire in it. When repaired, a crack about 4" long was found in the flue sheet, and the sheet was so thin you could punch a hole through it with a chisel.

I know a case in which an upright boiler was reported unsafe. The boiler was about 8-horse power, being used in pile-driving on a railroad. The master mechanic and superintendent made sport of the engineer, calling him a coward. He was finally persuaded to go to work, and within forty-eight hours the boiler exploded, instantly killing the engineer and severely scalding and maiming several others. The railroad company got off with $5,000 damages, making the boiler rather an expensive one. I could name twenty similar cases resulting from a lack of inspection.

If there was a good system of boiler inspection in force in the State, and none but competent men in charge of boilers, boiler explosions would be unknown.

A. L. CANFIELD.

A Hinged Lathe Apron—Emery Wheels in the Shop—Drawing and Books on Drawing.

Editor American Machinist:

If P. C. Forrester, who in your issue of Oct. 27 sighs for a hinged apron, will take a trip to Hamilton, he can see a lathe in which by taking out a single bolt the apron can be swung out for oiling and inspection. This lathe was designed by Chordal, and has been running several years. The artist who presides over it, says he would not exchange it for any lathe in the shop.

His wrinkle of polishing with emery cloth on a mandrel is a good one, In addition to its practical utility it suggests an inquiry as to why shop owners do not use more emery wheels. I have seen bushels of new files ruined for the want of good emery wheels. What I mean is, a good solid iron frame with a coarse wheel on one side and a fine one on the other. Some one will say they will not stay in condition any longer than till the boring mill man comes along with a mushet steel tool, but there are ways to provide for the boring mill fiend, and preserve the wheel.

Chordal's remarks on drawing are right, as I know by experience. You can get a book on drawing for from $4 to $18, and I think the better way is to spend that money on better tools, and then ask some good-natured superintendent for the use of some old drawings to copy. He will not refuse, unless he is one of the kind that has forgotten the time when he was poor and worked for a living. EMERY WHEEL.

Hamilton, Ohio.

Strong Engine Lathes—Clean and Unclean Workmen.

Editor American Machinist:

In your manufacturers' column, I see that an Eastern machine tool works is getting out a new 16" swing lathe, which will be geared 16 to 1. I have always believed that the majority of lathes are deficient in power in the spindle gearing, the average lathe being geared 8 to 1. There is no reason why roughly forged steel or iron crank-pins, and work of that class cannot be turned as quickly and effectively in a small lathe, if properly geared and constructed, as in a large one. For light work, a handy lathe is the thing, but a lathe may be both handy and strong. In many shops where locomotive work is done, the work is done by the piece, and at a low figure. On such work, when heavy, the speed and cut are generally governed by the power, and the feed by the rigidity of parts.

I was amused with Chordal's description of clean *versus* greasy workmen. It is all in habit, and the latter are made by beginning in a rushing, slovenly, tear-away style, without any order. Some men never seem to know the use of waste, their hands are always oily, and everything they touch is of course the same.

There is a good deal in the subject of clean and dirty workmen. If a man keeps

his person, clothes, and bench or machine in a dirty, disorderly, greasy, and filthy condition, he will not, amidst such surroundings, do good work. J. K. C.

Chaplet Bar and Chaplet for Columns.

Editor American Machinist:

I have seen more wedges, bars, and clamps used, and more fuss made in chapleting and securing chaplets in columns than in any other job that comes into the average foundry. Especially I have seen more anxiety about the final results of such wedging and clamping.

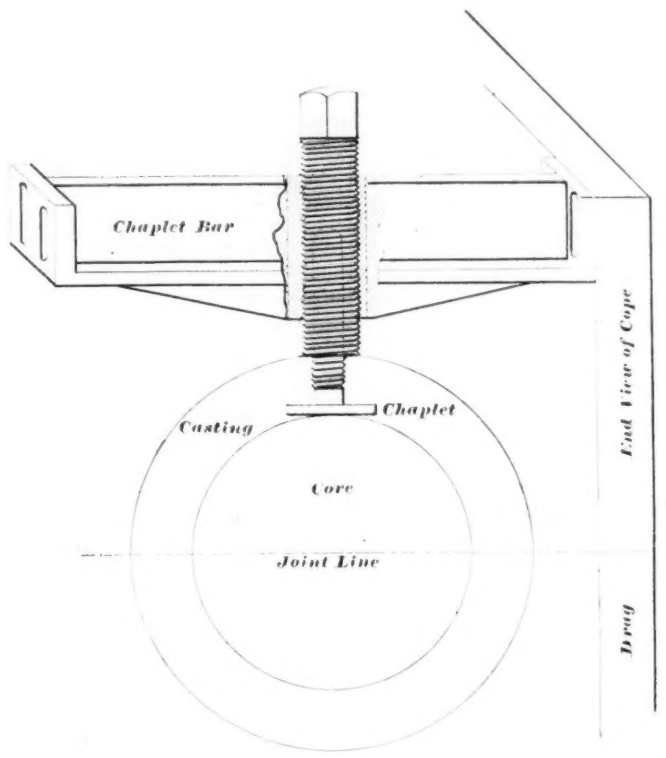
The sketch represents a device that will save a good deal of worry in this respect, and help in securing good work. As will be seen a bar is made to bolt in the cope, the bar having a boss at the center tapped for the screw bolt shown. This bolt is drilled and tapped from the lower end, a sufficient distance, for the screwed stem of the chaplet, the construction being clearly seen in the sketch.

When the cope is placed on to be rammed up the bolt is screwed down to the pattern, and when ready to close the flask the chaplet is screwed down until it stands away from the bolt the proper distance to leave the required thickness of metal.

The use of this does away with the necessity of traps and make-shift arrangements, and avoids the probability of jarring off sand in wedging chaplets, as well as the occurrence of other accidents. After the mould is poured, and when ready to remove the cope, the screw bolt is to be removed with a wrench. It may not be necessary to say that the screw threads should be reasonably coarse, as there is always *some* sand around a foundry floor.

Perhaps, in some instances at least, drilling the screw bolt its entire length and letting the stem of the chaplet pass up through it so that the latter could be adjusted after the cope is in place would be desirable.

FOUNDRYMAN.



CHAPLET BAR AND CHAPLET FOR COLUMNS.

Western Shop Kinks.

Eitor American Machinist:

I work in a Western shop. Not one of the shops in the neighborhood of Chicago, or St. Louis, where tools and appliances are equal to, or a little ahead of Massachusetts, but away out on the Pacific side of the Missouri River. Of course we do not enjoy the best facilities for doing work, but we manage somehow to get along. The absence of perfected tools for every department of machinist work is not without its advantages, as it tends to develop individual ingenuity. Some of the men trained under our conditions of servitude do not understand what defeat means in doing difficult machine work.

Last week I mentioned a shop kink got up by one of these men who have the faculty of devising means of overcoming every mechanical difficulty. This fellow told me that in turning packing rings he had tried all sorts of methods, some of shop inheritance, others devised by himself, but he could not get the sides parallel. He had turned the casting in and out, faced one side and cut it off, making three true faces as it came from the first operation, but to get them parallel on the sides was a poser. He had made mandrels out of old castings and held them by various means, but it was next to impossible to get every set of rings to turn out right. After various other failures and urged on by necessity, the mother of invention, he produced a chuck mandrel like what is shown in Figs. 1 and 2, and there is nothing to equal it for holding piston rings. Fig. 1 represents the cross section of the rig. On the circular flange, four arms, *B*, are bolted through an oblong slot, shown clearly in Fig. 2. On the stem of the mandrel is a tapered collar, *C*, which on being pressed inward by turning the nut *D*, presses out the arms till they hold the ring tight. The arms move in slots planed in the face of the casting about $\frac{1}{8}$" deep. Hardened steel centers are screwed into the ends of the mandrel.

When this same Western man began running a piston lathe he was at a loss to find something that would stand the pressure that heavy cuts on piston heads put on the rod. He said, "I first used a steel key which would not allow of large cuts, as I found out during the first day I ran the lathe. I went out for something, and in my absence the key concluded it had too much to do, so the piston stopped and the key went on. When I got back the key was in a hard knot, wrapped around the rod twice. Then I set on my thinking cap, and among various ideas captured that which brought out Fig. 4. This has never refused to drive under the most pressing labor." When there is no key slot, the clamp with set screw described last week will do very well.

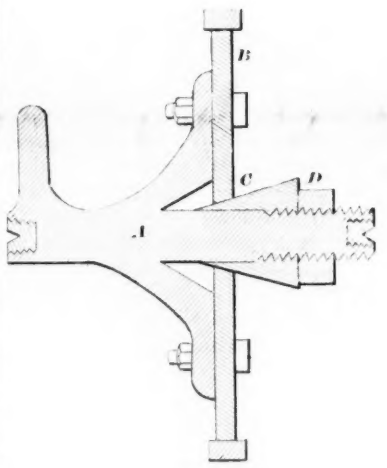


Fig. 1

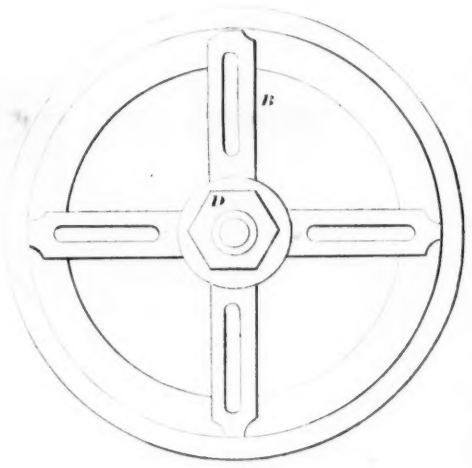


Fig. 2

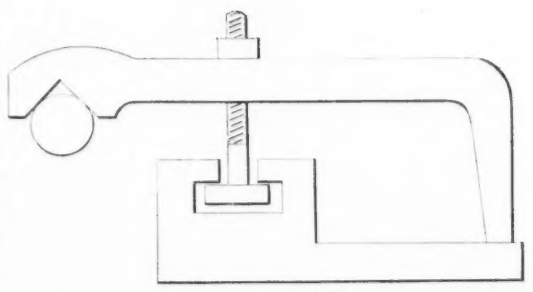


Fig. 3

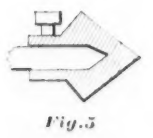


Fig. 5

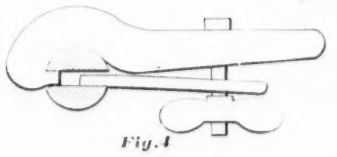


Fig. 4

As we were talking about this lathe driver matter we were interrupted by a man who wanted to borrow a pipe center. My friend took from his cupboard something which was new to me in the line of centers. It was like a pipe center with the big end cut off and a hole bored in it to fit on the outside of an ordinary center. Its appearance is reproduced in Fig. 5. It is handy, and if always put on in the same way it was turned up will run true every time.

In turning shafting, which we get a good deal of, instead of using the steady rest or follower rest, I use a little idea of my own which allows me to take very large cuts in roughing out. I put the rig shown in Fig. 3 alongside of my cutting tool in the same slot which receives the tool-post, and the strains are entirely counteracted. An oblong slot for the bolt allows plenty of room for adjustment. L. A. SHARP.

New and Old Pyrometer Principles.

Editor American Machinist:

I notice a "somewhat novel" statement in your issue of the 27th instant, p. 5, that "a pyrometer, based on a somewhat *novel principle*, has been *invented in Britain* for ascertaining the temperature of furnaces and other intensely heated substances. The *new* pyrometer consists of a piece of metal of exact weight being subjected to the heat for a certain time and then plunged into a *measured* quantity of water. By calculations based on the rise of temperature of the water the heat of the furnace can be ascertained."

I underscore a few words, for reference. Invented? What room for invention can there be in an application of the long known and universally practised "method of mixture" in determining temperatures?

Where on earth is *Britain?*

What is the *novel principle* in this *new* pyrometer, unless it be the substitution of a *measured* quantity of water (an uncertain quantity) for a weighed or determinate quantity? Or is it in "calculations based on the rise of temperature of the water" alone, irrespective of the specific heat of both the metal and the water, which varies with the temperature?

There is certainly room for the exercise of skill, and possibly of invention, in devising certain details of the apparatus; such as the metallic heat-carrier, and contrivances for mixing the water to insure uniformity of temperature throughout; for reducing to a minimum the loss (or gain) of heat by radiation and exchange, and for reading temperatures to small fractions of a degree, $\frac{1}{100}$° F. or less. But all the principles involved are almost as old as modern chemistry, and have been often applied.

J. C. HOADLEY.

Boston, Mass.

[We cannot see that the writer of the offending paragraph was very far astray in his brief description. The application of the principle as applied in the invention referred to, was as truly novel as have been most of the inventions upon the lathe during this century. Webster defines novel as "something out of the ordinary course, or so much out of the ordinary course of things as to strike us with surprise." It is not of the same significance as *new*. We are not aware that a "measured" is an uncertain quantity. It is more convenient to ascertain an exact quantity by weight than by measurement, nevertheless measure is defined as "a quantity determined by a standard." Britain is the place where "British" people live, and one expression seems as sensible as the other.]

Cored Crank Shafts.

Editor American Machinist:

In making cast crank shafts, of whatever material, I have found, or think I have, an advantage in coring, not only the body of the shaft, but the pin as well. The ends of the holes in the shaft are easily plugged for finishing over. I clean out the hole through the pin, countersink the ends and drive a hot rivet before commencing to turn the shaft. I do this under the impression that it strengthens the pin. If of considerable length, I heat the ends of the rivet only.

FRANK GLEASON.

Many boys in the machine shop lose their opportunities of becoming skilled mechanics through waiting for a better job, just as men die waiting for something to turn up. There is no job to begin to do good work on like the one in hand, and no mistake greater than supposing that the very best mechanical skill cannot be shown on what would be called a very ordinary piece of work. Nothing is more common than to hear complaints from apprentices that they don't get an opportunity to learn the trade at which they are working, but generally speaking no one *gets* the opportunity; he *makes* it. There is no conspiracy to keep any one out of the position he ought to fill, but he must get into that position by his own exertions. If a boy demonstrates that he is capable of doing a simple job of work better than anyone else, he is morally certain to get tried on a better one, if there is a better one. If he fails to do the present job right because there isn't scope enough for his ambition, he makes it appear that it would be unsafe to trust him with better work. There is no other sure road to advancement than through present duties well performed.

One thing likely to strike those accustomed to mechanical appliances is the amount of energy displayed in the attempt to do away with the use of the crank. The Patent office records show conclusively, that there are yet many who labor under the delusion that there is some mysterious loss of power in the crank. Those who think this is true would do well to investigate the subject.

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NEW YORK, NOVEMBER 10, 1883.

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The price of the AMERICAN MACHINIST was reduced, beginning with last week's issue, to five cents a copy, or $2.50 a year. Readers who do not find copies for sale by newsdealers in any part of the United States or Canada where they have asked for this paper, will confer a favor by dropping us a line about it.

Evening Mechanical Schools.

Last winter there was an intellectual awakening among mechanics all over the country. In factory and in workshop the sentiment that more knowledge is needed had found believers and disciples. As our mechanics are deservedly noted for being eminently practical they did not allow the sentiment which called for more education to evaporate in idle talk. They set to work and evening classes for mechanics were started in numerous cities and towns, and they did good service during the long winter evenings by enabling young men to improve themselves in the scientific branches of the arts they are learning. When a youth about fifteen or sixteen years old begins to learn a trade he may be well grounded in the ordinary branches of school education, but unless he has some opportunity of brushing it up, during the years of his apprenticeship much of what he learned will be forgotten. The evening school does an excellent part in conserving the knowledge which boys have acquired, while it penetrates into the practical branches which the ordinary school course sedulously avoids. But perhaps the greatest advantage which young men will reap from attending evening schools is that habits of study acquired at school will not be lost.

The indications are that many new evening schools will be opened this season. We would earnestly urge every mechanic who is ambitious to elevate his position in life to give evening classes his countenance and support. Industry and perseverance during a season will enable one to make gratifying progress in draughting and in mathematics, and it gets a man into habits of attending to these subjects. But merely helping to start a class and bearing a share of the expense will not secure for a man the benefits of instruction. He must give the classes his regular attendance, and the subjects must be studied. It requires some perseverance and not a little labor, but these are well rewarded to him who overcomes the introductory difficulties. He and such as he will own and superintend the machine shops of the future, as men of such attributes are those who take the lead to-day.

Ventilation of Passenger Steamers.

In examining the multitude of staterooms, cabins, saloons, and other apartments of a great ocean steamship recently, we were struck with the extremely defective methods of ventilation used to supply fresh air to the thousands of persons confined under deck, which is actually the condition of affairs in bad weather. Although in every other respect the steamboat companies have called the best mechanical appliances to their aid in increasing the safety, comfort, and convenience of their vessels, the antiquated wind-sail and bell-mouthed ventilator have been deemed the proper means for circulating air below the decks. These venerable devices convey a miniature hurricane to local points in windy weather; but for inducing a mild circulation of air through all parts where people are breathing they are a decided failure. As this defective means of ventilation throws too much air upon certain portions of the hold, the supply is often checked by those who object to drafts; then the remote portions of the vessel suffer worse than ever.

Means ought to be devised to circulate air in a uniform manner through large vessels by means of power fans. Or, the air needed to supply the furnaces with oxygen might be drawn by means of pipes evenly from all parts of the hold, thereby inducing a movement of fresh air to the points which now suffer chronically from bad ventilation.

A Chance to Demand the Abolition of the Prison Contract System.

Once in a great while a purely industrial question comes up for settlement by voters at a general election without involving any struggle for office or any change in the fortunes of a political party. An instance of this kind occurred in the State of New York last fall, when by an overwhelming majority the people adopted an amendment to the constitution, making traffic forever free on the canals. The wisdom of their decision has already been shown, in the transporting over the canals of 544,000 tons in excess of any previous year. But the canal question was in its nature somewhat local, and the taking of tolls did not wrong or oppress any portion of the citizens. This fall the voters of the Empire State will express their will at the ballot-box upon an industrial question of far wider and higher importance—one involving the rights of manufacturers and mechanics to immunity from unjust and often ruinous competition, sustained by the government they themselves are taxed to support. They will vote for or against a proposition to abolish the contract system of labor from prisons and other penal institutions throughout the State. The result of the vote will not be authoritative, as it was with the canal toll question, but no legislature can afford to disregard the directly expressed will of a majority of citizens of the State. A strong majority *for* the proposition would undoubtedly mean the end of the contract system. The evils of this system as now practiced are too flagrant to be disguised. The labor of several thousand prisoners is jobbed out to a few favored contractors at from twenty-five to sixty-five cents a day for each well and able-bodied man, the State boarding, clothing and sheltering the convicts, besides furnishing free shops and power for the contractors' use. The manufacture of stoves, hardware, boots and shoes, and other articles, is carried on in these shops by the labor of the convicts. The ability of each convict is ascertained and a daily task is assigned him, which he must perform or receive a severe punishment. The contractors are therefore secure from all outside competition. Manufacturers and mechanics must suffer this unwarranted opposition as long as the odious contract system is allowed to stand. Several successive legislatures have dabbled with the question only to evade it and leave the contractors more strongly entrenched in their position, until finally it is thrown open to the people to vote upon, as a convenient way to dodge the responsibility.

Of course the contractors will struggle to hold their lucrative grasp upon the prisons. Their privileges are worth millions of dollars, and they can well afford to set aside a moiety for those who will help them in the contest. Certain newspapers are trying to persuade their readers that if the labor of prisoners is not jobbed out to contractors they will have to be supported in idleness at the expense of the taxpayers. Such a plea is worse than silly—it is an effort to make the worse appear the better part of reason. What would be thought of such a ridiculous plea in monarchial England, where no such system exists and where convicts are sure to be kept at hard labor? Not one of these newspapers has heard apparently that California abolished the prison contract system years ago, and that her convicted criminals are all employed at hard labor, paying the expenses of keeping them, in occupations that do not conflict with any free industry in the State. Other States can do the same. The contractors will make every effort to get votes to perpetuate the present unjust system. Manufacturers and mechanics of the State of New York should see that tickets *for* the proposition are distributed before election day.

Since writing the above, we have received a 157-page pamphlet entitled, "Prison Labor. Some Considerations in Favor of Maintaining the Present System." It emanates from John S. Perry, whose firm has a contract for the labor of 900 convicts in the Sing Sing prison stove foundry, at 65 cents a day each. It contains nothing more than the usual stock arguments of the prison contractors and their supporters, except this: "Perry & Co. have shown by their records that convict moulders produce but *forty-seven per cent.* as much as citizen moulders." Then the citizen moulder must work for $1.38 a day to compete with Perry & Co.'s convict moulders, at 65 cents a day each, so the work turned out will cost the same. Stove plate moulders when they work, make $4 to $5 a day, and outside of prisons stove manufacturers do not have free shops and free power. It is plain that Mr. Perry can afford to print and circulate bulky pamphlets appealing to the voters to sustain the "present system." We have also received copies of daily papers with blue pencil-marked appeals to voters to uphold the contract system.

There is a violent struggle going on among certain European makers and dealers in machinery to maintain a hold on the trade with Brazil. It appears that British dealers secured the lion's share by extending long credit, which seems to be necessary for holding that trade, the payments often extending over two or three years. After a time, German hardware merchants began to imitate British methods, with the improvement of underselling. Now French Consuls are showing their countrymen how a share of the business can be secured, and all three nations are striving to outbid each other. The main inducement is extended periods of credit. Should United States manufacturers step into the conflict, we expect to learn that sales will be made for machinery to be paid by the heirs of the buyer.

If American ingenuity has led the world in developing means of rapid construction, our inventors do not always get credit for their enterprise and ability. In many technical books of reference published in this country, we are told that standard gauges and the system of interchangeability were introduced by a European engineer about the year 1840. Now, although it is not so well known as it ought to be among American engineers, Eli Whitney, the inventor of the cotton gin, started in 1798 an establishment for the manufacture of small-arms, the work being done on the interchangeable system. He used templates and hardened jigs, and the sizes were arranged upon the recognized standards, the inch being the basis of measurement. This was not a transient experiment, for this system of making arms became firmly established, and in 1800 the Government Springfield Armory was fitted up under Mr. Whitney's directions. So late as 1855 the British Government got machinery from the Springfield Armory to enable them to introduce our interchangeable system of making fire-arms, and private establishments in that country have given many orders to American machinery establishments for the same class of machinery.

Boiler explosions on steamboats are more common occurrences than could be desired, but an event of that kind is hardly looked upon nowadays as a necessary evil which must be endured because it could not be cured. Yet this was the light in which explosions were regarded in the early steamboat days. In a well-known scientific work published in Scotland fifty years ago, the writer, describing the conveniences of American steamboats, says that in the most improved vessels the cabins are placed so that the passengers will not get hurt or scalded when the boiler explodes.

In a Western industrial newspaper we find an article improperly credited to the AMERICAN MACHINIST, in which the following expression occurs:

"Yet this progress has been achieved in face of formidable obstacles, chief among which may be mentioned the high price of labor and the raw materials. For years iron and steel have been sold here at rates enormously above those of other countries, and the consequence has been the handicapping of many of our most important industries."

We never made any such false and non-

sensical statement in these columns. It probably originated in some free-trade daily newspaper, and the writer was no doubt anxious to tell all he knew and as much more besides.

Curious Guild Restrictions.

In a pamphlet published by the Cutler's Company of Sheffield, England, giving an account of the development of the cutlery trade, many curious facts are mentioned. In the early part of last century Sheffield was extremely poor, and a historian of the period attributes this condition of things to "the ease with which the operative mechanic could establish himself as an independent manufacturer." The trades guilds, which did so much to build up the influence of artizans in Europe, placed some curious restrictions on the makers of cutlery. Our machinists and tool makers would be disposed to strike against an order that, no master, servant or apprentice shall perform any work appertaining to their science or mystery for eight and twenty days ensuing the eighth day of August each year; nor from Christmas to the twenty-third day of January.

No person was allowed to exercise the trade who had not served an apprenticeship of seven years, or been instructed by his father for that term. Sons very often followed the trade of their father and the "mysteries" were handed down from generation to generation. There were advantages in learning the trade in the family circle, for strict penalties were enforced against cutlers having more than one apprentice in his service at one time, nor were they allowed to engage a new apprentice till the old one was in his last year, and none were taken for a term shorter than seven years. These people held very restricted views on the protection of their industries, for no occupier of a wheel was to suffer any person to grind or glance any knives there who did not reside within the "lordship," and no one was suffered to follow the trade there unless he had learned it in the same place.

Literary Notes.

WORTHINGTON'S ANNUAL FOR 1884. PUBlished by R. Worthington, 770 Broadway, New York.

Contains a series of interesting stories, biographies and papers on natural history for the young. It has over 300 fine engravings and is every way a creditable book.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(352) A. H. C., New York, asks: How many good impressions can be taken from a wood-cut such as you use? *A.*—If the wood-cut is properly handled, one million satisfactory impressions can be made. It is customary to use electrotypes made from the wood-cuts, to avoid danger of accident to the latter. A good electrotype will last for as many impressions as the wood-cut.

(353) W. H. R., Millbury, Mass., asks: What causes the upper end of my glass water gauges to eat out? We think the water is very pure. The boilers are always clean and smooth when opened for inspection. *A.*—It is not the water that eats your glasses, but the gasket with which they are packed. There is no remedy except to try different gaskets until you find the best. Winding the gasket closely with lamp wick is sometimes beneficial.

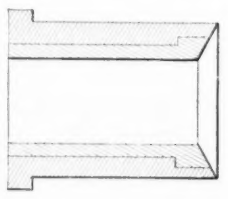
(354) A. W. S., Chicago, Ill., writes: Will you inform me where I can get a work on the manufacture of emery wheels? What I wish to know is how they are pressed together and if they are left under pressure considerable time? *A.*—There is, so far as we know, no work published on the subject. Different wheels are subjected to different processes in their manufacture. Some manufacturers subject them to very high pressure, others not so high. The time they remain under pressure is similarly varied. Most of the processes of manufacture are protected by patents.

(355) O. A., Croton, N. J., writes: In putting in a heating device similar to that described by Sutherland in the AMERICAN MACHINIST of May 21, 1881, would it be advisable to let the hot-air pipe empty at the top of the room and then have four ventilating pipes—one at each corner of the room—coming down within six inches of the floor to let out the cold air and provide circulation? *A.*—Your ventilating pipes will probably work satisfactorily, but we do not see that you will gain by discharging the hot air at the top of the room. We should suppose you would get a more even temperature by taking in the hot air near the floor and allowing it to rise through the space.

(356) W. F. N., Decatur, Ill., writes: I have charge of a horizontal boiler set in brick work. At back end an iron plate, with mortar on top of it, covers the opening. I have trouble with this plate moving away from the boiler, leaving a crack through which fire and smoke escape. Is it caused by the expansion of the boiler or of the plate, and how can I remedy it? *A.*—It is probably caused by the expansion of both boiler and plate. You can remedy it by building a brick arch top of the plate, which will yield as expansion and contraction takes place, or you can carry brick work up and over the top of the boiler for a few inches. See illustration in AMERICAN MACHINIST of October 21, 1882.

(357) Draughtsman, St. Louis, Mo., writes: I would like to know the proper size and speed of a wire rope driving a four-foot sheave, to lift 10 tons at the rate of 40 feet per minute. The lifting hook block has a single wheel chain coiling on a 30-inch grooved drum, the proper speed of which I can get by gearing down from the sheave shaft? *A.*—Making a liberal allowance for friction (25 per cent.) you will need to provide for about 30 horse-power. To do this with wire rope it would be better to use ½" rope on 7 foot pulleys, running 140 revolutions per minute. It is not recommended to use larger than ⅜" rope on 4 foot pulleys, which would require to be run at a speed of from 700 to 800 revolutions per minute, and would, without doubt, be unsatisfactory. As a rule it is better to use large pulleys for wire rope transmission. 2. What is the loss of power in gearing with cast gears? *A.*—There are no reliable data on the subject.

(358) E. H. A., Pittsburgh, Pa., asks: How can I line a stuffing box follower with brass? I have no hydraulic press to force in the lining. *A.*—Bore out the follower so as to put the lining in



with a shoulder, as shown in sketch. You do not need a hydraulic press, as the lining needs to be driven only moderately tight. It is better to bore the lining or bush a little small, and after driving in chuck the follower quite true by the outside and then bore the bush to fit the rod.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Match Machinery, F. Chillingworth, New Haven, Ct.

F. VanWinkle, Mech. Engin'r, 22 Cortlandt St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N.J.

"Tack Machinery"
Willets Manufacturing Co., Providence, R. I.

4x4 engines, stationary or marine. N. C. Heaton, 332 Water street, New York.

Steam Engine Castings, ½ and 1 H. P. Samuel Harris & Co., Canal st., Chicago, Ill.

The latest Improved Match Machinery is made by the White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh Wells, & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 58,) New York City.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Jack pump and ladder chain machines, 40 to 80 links per minute, direct from coil. The Gaylord, Cross & Speirs Company, Waterbury, Conn.

William J. Baldwin, consulting engineer in Steam Heating and Ventilation. Author of "Steam Heating for Buildings." Office, 96 Fulton st., New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880, 1881, and 1882. A limited number of each sent by express for $3.50 per volume, express charges to be paid by purchaser. AMER. MACHINIST Publishing Co., 96 Fulton st., New York.

Patent "Common Sense" Binder for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address, in the United States, by mail for one dollar. To Canada and foreign countries 75c., the purchaser to pay custom-house duties and express charges. American Machinist Publishing Co., 96 Fulton street, New York.

"HOW TO KEEP BOILERS CLEAN."—A book of seventy-two pages, telling how to prevent scaling, foaming, priming, and burning, with other valuable information, will be sent to any address FREE of postage, by James F. Hotchkiss, 86 John street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. AMERICAN MACHINIST PUBLISHING COMPANY, 96 Fulton street, New York.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

MANUFACTURES.

The Novelty Iron Works, of Cleveland, have been incorporated, with a capital stock of $60,000.

The Matthews Cotton Mills, Selma, Ala., will erect a new mill, equal in size to the present factory.

G. W. Hollis will erect a brick factory at 546 West Fifty-seventh street, New York, at a cost of $25,000.

The Water Commissioners of Buffalo want bids up to November 8, for an engine, boilers, chimney and foundations.

Thomas Lombard's foundry, Augusta, Ga., has been sold to H. H. Folger, who will build a 100x40 foot furniture factory.

The Florida Southern Railroad Company have made arrangements for establishing an iron foundry at Palatka, Fla.

The Moore Water Tube Boiler Company is a new establishment just started, with a shop at 42 N. Holliday street, Baltimore.

The Magee Furnace Company will erect, in addition to its works at Chelsea, Mass., a brick building, 170x66 feet, five stories high.

Flavell Brothers, 31 Mill street, Germantown (Philadelphia), Pa., are about to make considerable of an addition to their hosiery mill.

The Fowler Manufacturing Company, Limited, will erect a $32,000 brick factory on Twenty-third street, near Eleventh avenue, New York.

L. Power & Co., manufacturers of wood-working machinery, Philadelphia, Pa., have moved into their new shop, 93x60 feet, four stories high.

George H. Toope will erect a new iron foundry building of brick at Ninety-first street and First avenue, New York. It is to cost $10,000.

The Buckeye Malleable Iron Company, Columbus, Ohio, is a new concern that has erected new works and will start with about fifty men.

Kenosha, Wis., is expected to have a new wagon factory soon. Capitalists have looked over the grounds and the preliminary steps are being taken.

G. W. Bannantine, of St. Louis, has purchased the Works of the Standard Tool Company, in that city, for $15,000. The shop will probably be started up soon,

Robert Tarrant is erecting a machine shop 75x100 feet, four stories in height, with basement, near the corner of Illinois and Market streets, Chicago. The cost of the structure will be $25,000.

Robert Brown, Norwich, Conn., dealer in gas, water and steam pipe fittings, also plumbers' materials, has added a new brass foundry to his business, called the Pequot Brass Foundry Company.

A new corporation, known as the Brown-Bonnell Iron Company, has been formed in Cleveland, Ohio, with $1,200,000 capital, to take the mills, furnaces and iron business of Brown, Bonnell & Co., of Youngstown.

Montague & White, of Philadelphia, will soon erect an addition to their mill. The building will be of brick, three stories high, and cover 21x160 feet. It will adjoin their present mill corner of Howard and Burke streets.

The Cleveland (Ohio) Electric Company, a new organization, of which S. E. Henderson is President, will fit up a new factory to make sewing machine motors, foot lathes and electric light apparatus. Capital, $100,000.

Gilman B. Seely, 349 West Fourth street, New York, will erect a brick factory at 319 West Fifteenth street.

The Hawley steam snow-plow, which attracted so much attention at the Railway Exposition, is to be manufactured at the Dickson Locomotive Works, at Scranton, Pa. It will also be built at Toronto or Montreal.—*Railway Age.*

E. W. Bliss, Brooklyn, N. Y., has just issued an illustrated catalogue and price list (232 pages) of presses, dies, machine tools and special machinery A large variety of machines for manufacturing tin and sheet ironware are represented.

It is said that the Hall Safe and Lock Company, of Cincinnati, Ohio, will establish a factory for the manufacture of its goods near Chicago, at an early day. Ground has not been purchased yet, but suitable sites are examining with that object.

The Enterprise Oil and Manufacturing Company is a new organization at Nesbitt, Miss. The capital stock is $100,000. Cotton seed oil, spokes, handles and felloes will be manufactured. The machinery has been ordered, and a building is being erected.

The firm of Ladd, Fortin & Volmuth has been dissolved, and has been succeeded by the Chicago Automatic Engine Manufacturing Company. This company has gone largely into the manufacture of automatic engines, pumps, &c.—*Industrial World.*

The Shepard Hardware Company, of Buffalo, N. Y., have just moved into their new quarters, the main building of which is 550 feet long, 260 feet wide, with wing 45x180 feet, covering over three acres. This new plant has been furnished with improved machinery throughout.

The Union Steel Company, of Chicago, has been incorporated to succeed the Union Iron and Steel Company, whose failure made such a flurry in the iron trade a few weeks ago. The creditors of the old concern will receive fifty cents on the dollar in cash or stock in the new company.

Wm. Strange & Co., Paterson, N. J., have commenced an extensive enlargement of their silk mill. Excavations for the foundations have been commenced, and the contractor has engaged to have the building completed by January 1st. The addition will be of brick, three stories, 45x200 feet.

Crangle & Elliott, Calais, Me., are building Elliott's new steam pump and have already placed a stock in the hands of selling agents in New York, Boston and Philadelphia. The firm is making arrangements to start a branch factory in St. Stephen, Canada, to supply the Dominion trade.

The Brainard Milling Machine Company, Hyde Park, Mass., have issued a new pocket illustrated catalogue and price list of Universal, plain index and special milling machines, mill and tool grinders, bench and pipe vises and milling cutters. It will be mailed to any machine shop upon application.

The Cleveland, Columbus, Cincinnati and Indianapolis Company has five cars in the shops to be remodeled. It is said to be the object of the company to place a smoking department in each car, so that first-class passengers will not be obliged to go in the smoking-car among second-class passengers to smoke.

Comstock & Preble, who are putting up a grist mill at Mazeppa, Minn., have decided to build their mill on the bluff above the dam and transmit the power for driving the machinery by cable. This will insure against all danger by flood, besides besides being more convenient for customers.—*The Milling World.*

Schutte & Goehring, manufacturers of the Korting steam jet condenser, have received patents for improvements on the condenser, which are said to greatly increase its efficiency. This condenser is gaining steady favor among owners of steam engines, and offers a simple means of obtaining the benefits of a vacuum in working a steam engine.

The Worcester (Mass.) Malleable Iron Company, who commenced to build their works in April last, have nearly completed the erection of their new enterprise at East Worcester, between the tracks of the Worcester and Shrewsbury and Boston and Albany Railroads, where they have 70,000 feet of land for their works adjoining both roads, on which they have a frontage of 465 feet.

A year or two ago large shops for locomotive building were erected at Garfield, a suburb of Chicago. For some reason not known to us the Chicago Locomotive Works were never equipped with tools, but the shops were sold to the Miltimore Elastic Steel Car Wheel Company, who also bought over 1,000 acres of land, and propose to build there a manufacturing town like Pullman.

It is said that the Corliss engine in the new Nourse mill of the Social Manufacturing Company, Woonsocket, R. I., is running on one and three-quarters pounds of coal per horse-power per hour. In the old mill not more than two and one-half pounds per hour were consumed per horse-power. Such results are worth the serious attention of steam-power users in every part of the country.

The *American Furniture Gazette* says: "The Rockford (Ill.) Union Furniture Company were made defendants in a ridiculous and unwarrantable suit last week. They had entered into negotiations for the purchase of property adjoining their present premises, but finally concluded not to buy. The owner of the ground was angered at the outcome, and by way of petty revenge began suit against the company for $1,000 damages, which he claims he has sustained by the sawdust which flies from their shops.

Machinists' Supplies and Iron.

NEW YORK, October 25, 1883.

The Supply trade continues fair without special activity. In American Iron, business continues dull and transactions unsatisfactory to sellers, with no immediate prospect of amendment. We quote: Standard brands of No. 1 X Foundry at $20 50 to $21.50; No. 2 X, $19 to $20. The transactions in Scotch Pig are limited with sales of Coltness, $23.25; Glengarnock, $23; Gartsherrie, $23.50; Summerlee, $22.50; Eglington, $20.50. These prices are at yard: prices are quoted to arrive at $0.50 to $1.00 less.

Antimony—Hallett's 8¾c.; Cookson's 10c.

Copper—Lake, 15c., to 15¼c.; other brands, 14¼c. to 14¾c.

Lead—Common Pig, 4.15c.; Refined, 4.20c.

Spelter—Refined, 8c. to 8¾c., with market quiet and unsatisfactory.

Tin, in jobbing lots—Banca, 21¾c.; Straits and Malacca, 20¾c. to 20⅞c., with light sales.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

A mechanical draughtsman of good technical education and experience, desires a situation. Address, Draughtsman, P. O., D 38, New Haven, Ct.

Wanted—Situation as Foundry Foreman, thirty years' experience: sixteen, as Foreman. Accustomed to all kinds of work, both light and heavy. Address, Foreman, care AMERICAN MACHINIST.

Wanted—An experienced foundry foreman: must be experienced on general jobbing, handling men, &c. Address, stating age, experience, reference, &c., "Melter," care of AMERICAN MACHINIST.

Draughtsman is open for engagement to design marine engines or general engine work. Has superior ability, theoretical knowledge, and long practice within this line. Address Draughtsman, AM. MACHINIST.

A mechanical draughtsman, experienced in designing machinery and superintending its erection, desires a situation. Specialties: Motive power, pumping machinery, and mill work. Address P. O. box 326, Moorhead, Minn.

Wanted—Parties traveling for other houses and selling to users of steam boilers, to take charge of a small and fast selling article; good references required and the kind of trade solicited. Address "Manufacturer," care AM. MACHINIST.

Tool Maker.—Wanted a steady, reliable tool maker: must understand the making of all small tools used in the manufacture of plumbers' and engineers' brass work. James Morrison, 75 and 77 Adelaide st., west, Toronto, Canada.

A reliable and competent mechanic desires a situation as superintendent or foreman. Experienced in management of shop and men, designing and constructing tools, fixtures, etc., for the economical manufacture of duplicate, or interchangeable work. Good references. Address, Box 2, AMERICAN MACHINIST.

Manufacturing property for sale, 30,000 feet floor space, competing point for four trunk lines railroads, switch from door. Write for terms and description B. W. Payne & Sons, Corning, N. Y.

Wanted—Some wide-awake concern to manufacture chain blocks and cranes of all kinds under recent patent. Correspondence solicited. Address, Box X, care AM. MACHINIST.

Wanted—To rent or purchase a good machine shop for manufacturing steam engines all ready for business. State full particulars carefully, including real name of owner, exact location, capacity of works, number, kind, size, condition of tools; price asked for rental or sale of tools, and rent of building. Immediate possession required. Address Reliable, care AMERICAN MACHINIST.

For sale—20"x48" automatic cut-off engine, good as new; two 60 horse-power double deck boilers, two years old; steam pump 10"x10"x36" stroke; Cameron pump, 6"x3 7/x6" stroke; one hundred ton hydraulic press, with hand pumps all in perfect order, and one old style Worthington duplex pump, set end for end, 12" steam, 7" water, 9" stroke, in good order. Address Room 19, Ledger Building, Philadelphia, Pa.

SPECIAL MACHINERY

Of light and medium weight made complete for use. Machines invented and designed and made to work in any practical purpose.

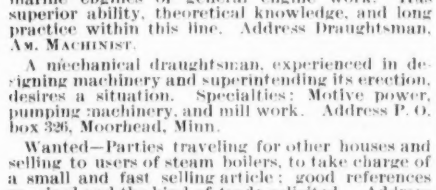
C. WING, Pattern Maker, Greenfield, Mass.

WILDE'S PATENT

Expanding Mandrel

is the most perfect novelty out.

SIMPLE, INEXPENSIVE, ACCURATE.



COOKE & CO.,

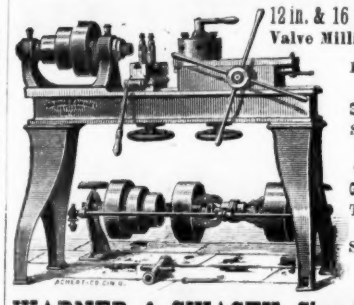
22 CORTLANDT STREET, N. Y.

Sales Agents and Dealers in General

MACHINERY AND SUPPLIES.

Write for circular and mention this paper.

BRASS WORKING MACHINERY.



12 in. & 16 in. Monitors
Valve Milling Mach's
Double Key Lathes,
Speed Lathes
Slide Rests
Revolving Chucks for Globe Valves,
Two-Jawe Chucks,
Small Tools and Fixtures.

WARNER & SWASEY, Cleveland, O.

"COMPOUND" BOILER;

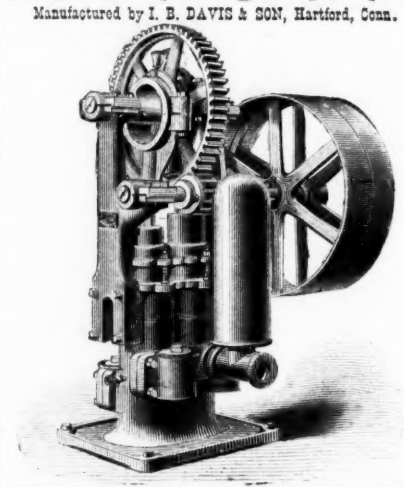
HOW TO USE IT AND RUN IT AT SEA.

Explaining causes of all corrosion and the formation of scale, with instructions for its entire prevention, together with useful information for maintaining Steam at Sea. Illustrated. By a Sea-going Engineer. 8vo, paper, 40 cents.

E. & F. N. SPON, 35 Murray St., N. Y.

The Economic Patent Boiler Feed Pump

Manufactured by I. B. DAVIS & SON, Hartford, Conn.



The only double-acting geared pump, geared five to one. All its parts are arranged for durability. It is made of the best material and in the most workmanlike manner. Economical in its operation. Interchangeable in all its parts. Duplicates of all the parts always kept in stock.

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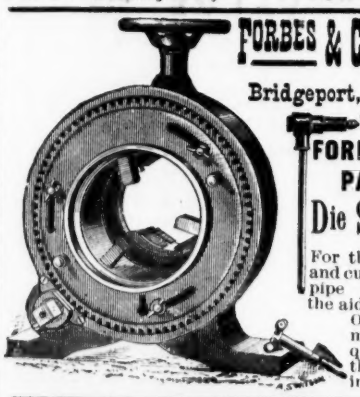

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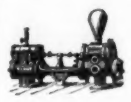

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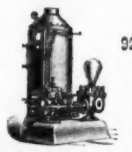

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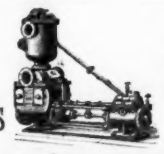

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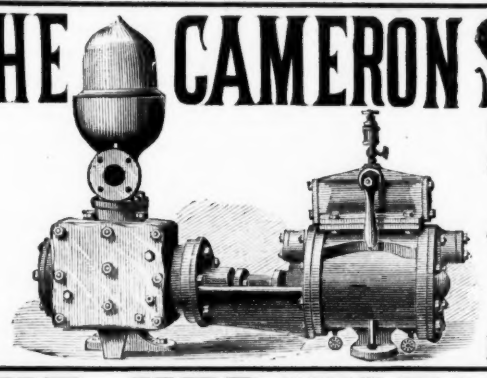

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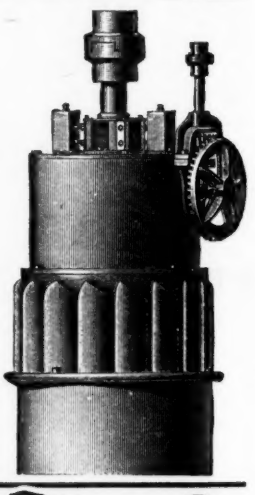

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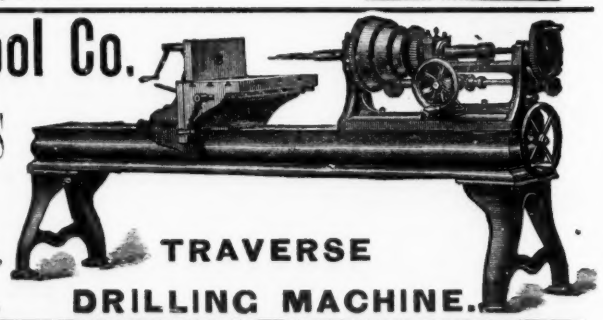

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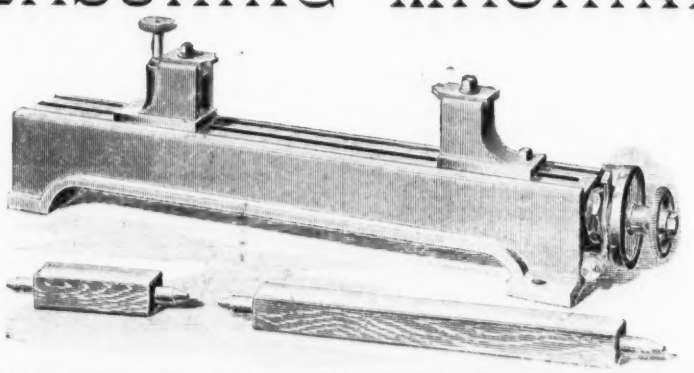

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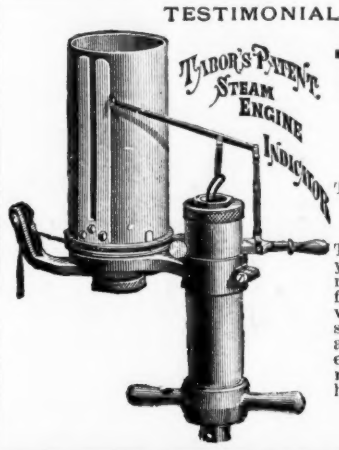

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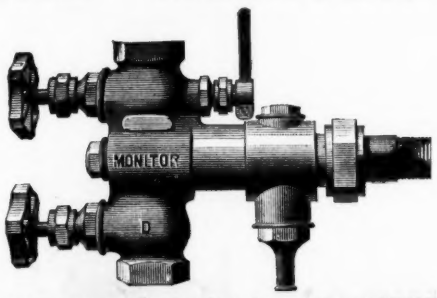

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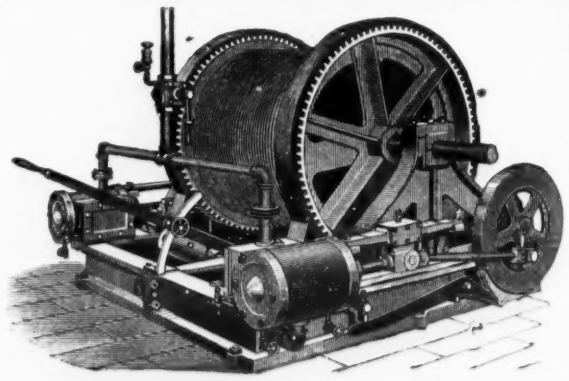

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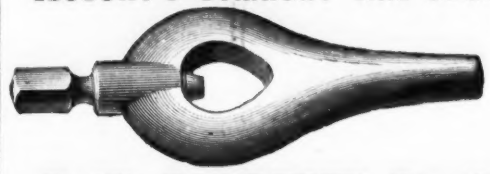

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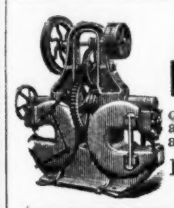

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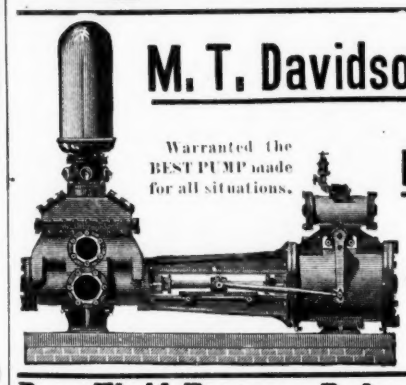

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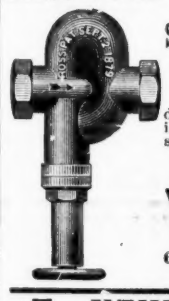

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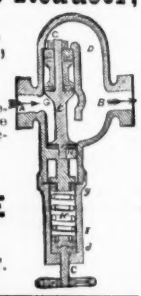

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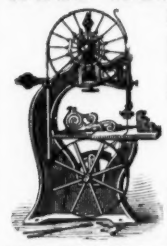

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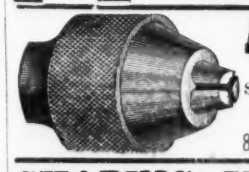

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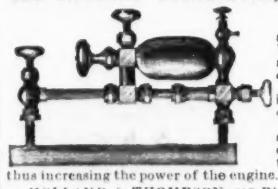

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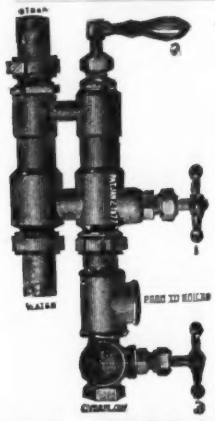

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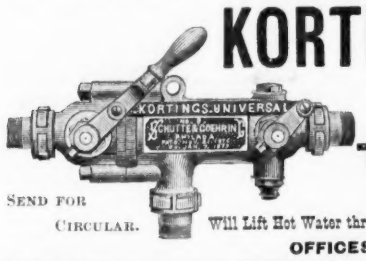

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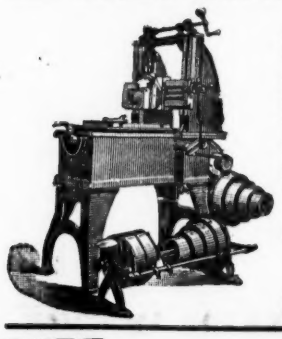

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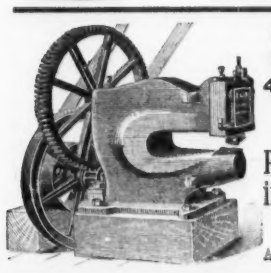

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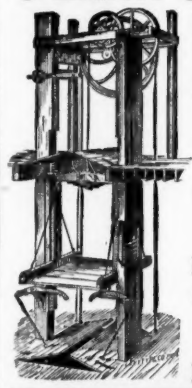

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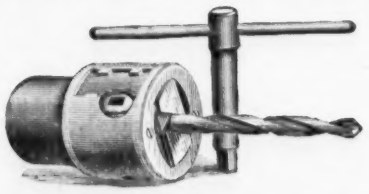

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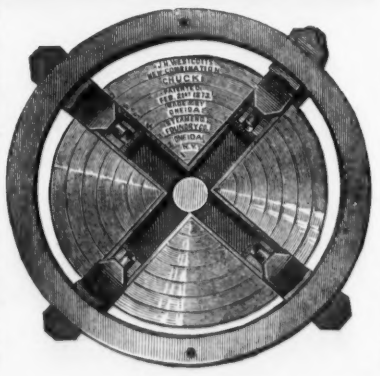

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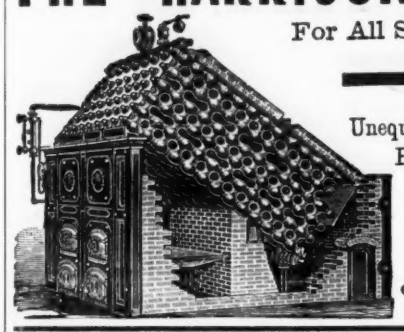

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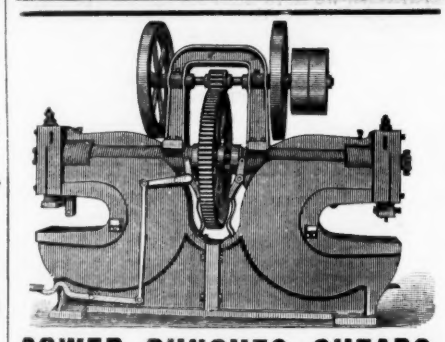

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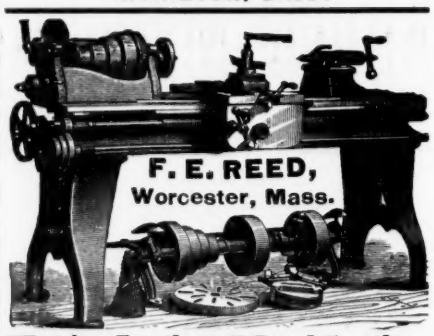

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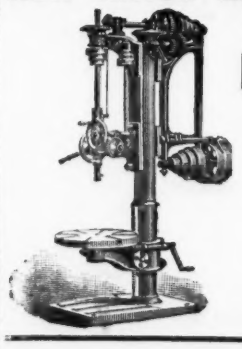

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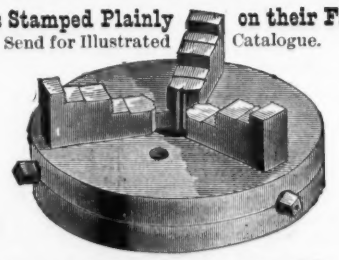

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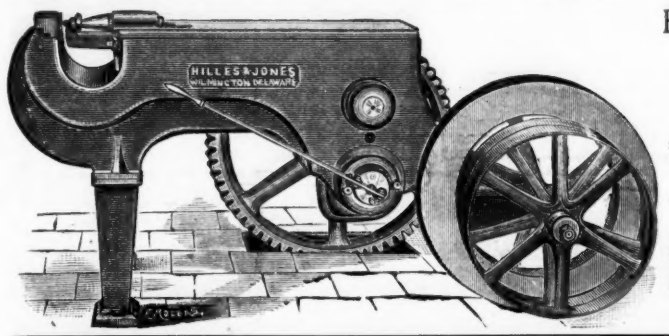

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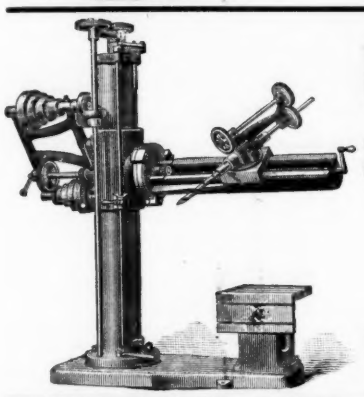

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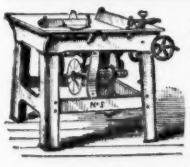

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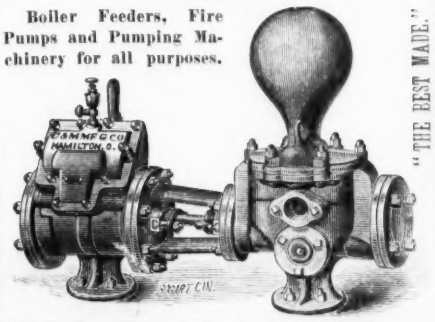

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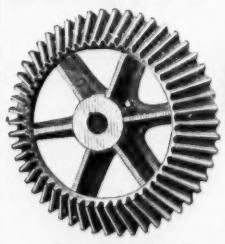

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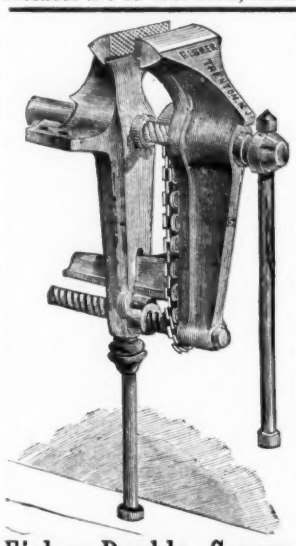

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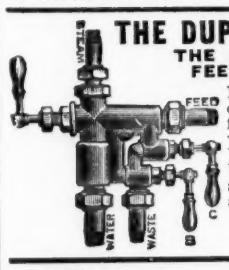

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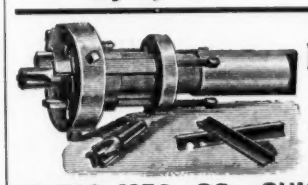

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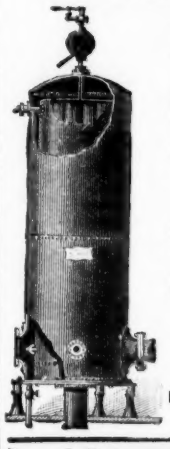

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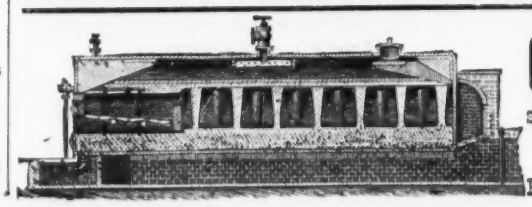

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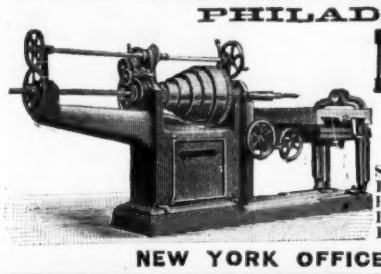

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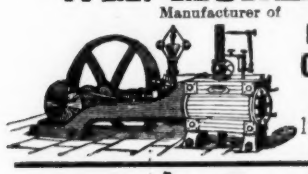

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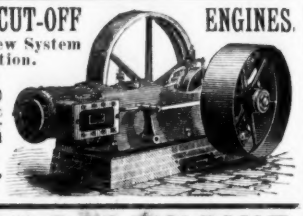

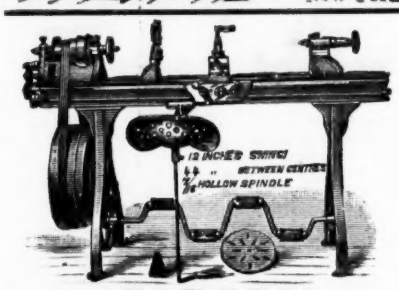

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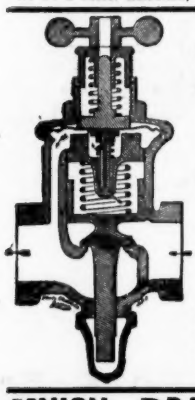

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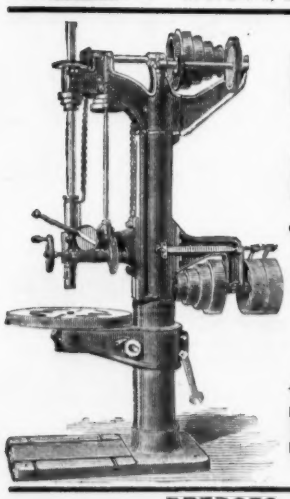

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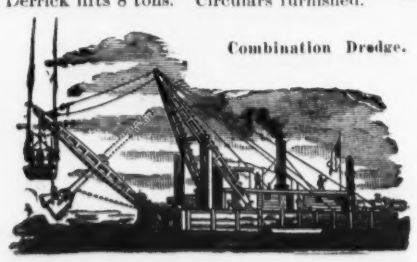

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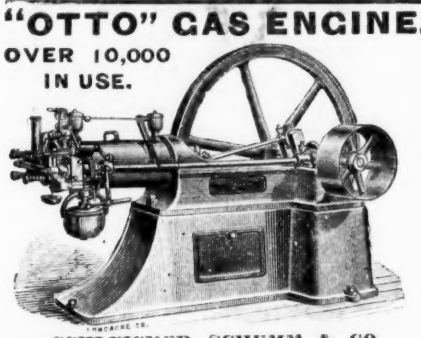

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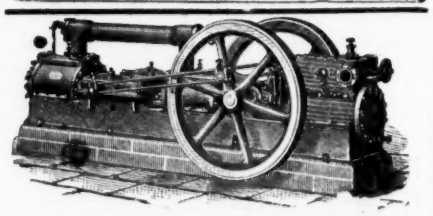

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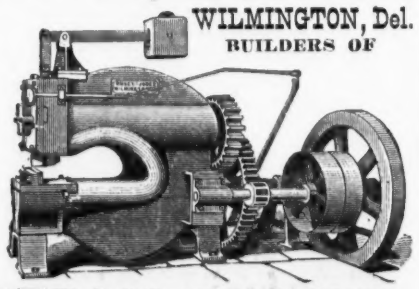

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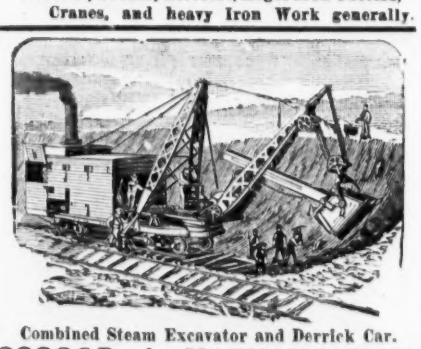

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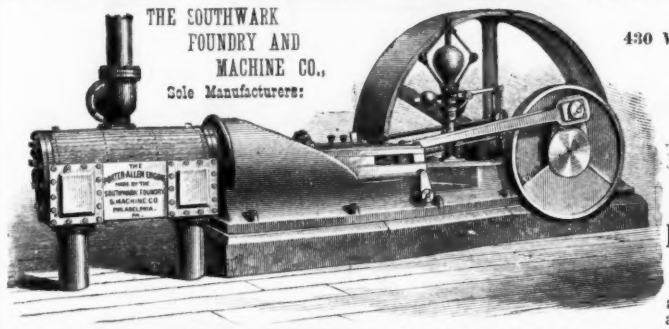

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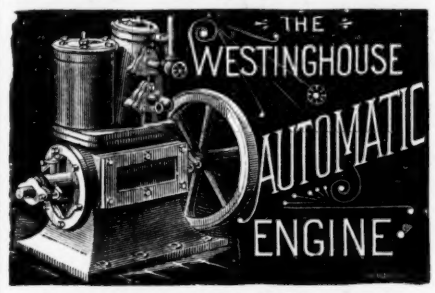

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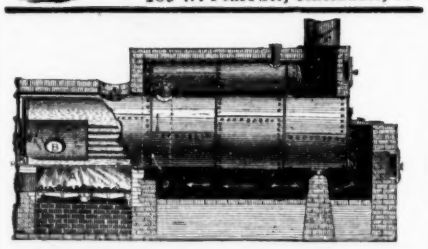

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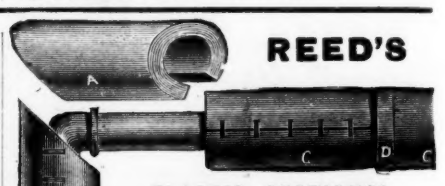

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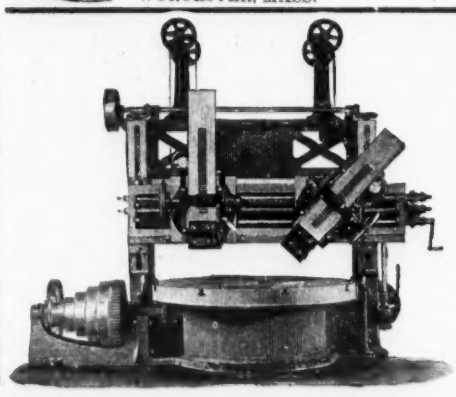

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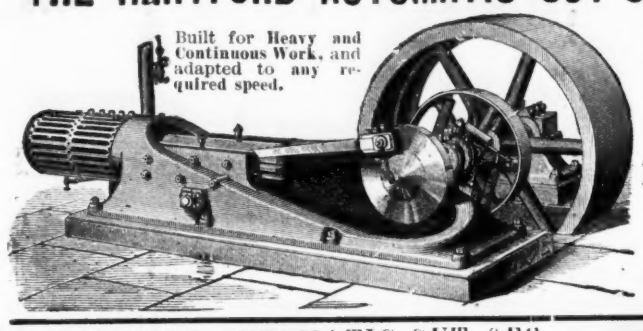

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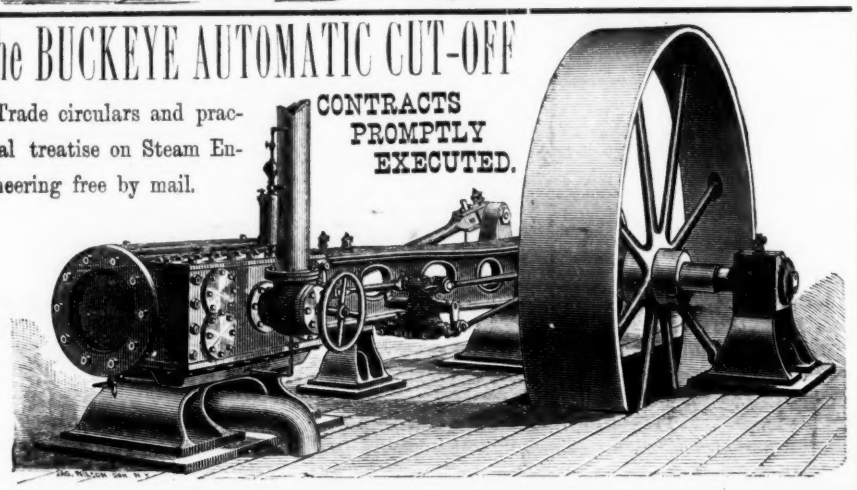

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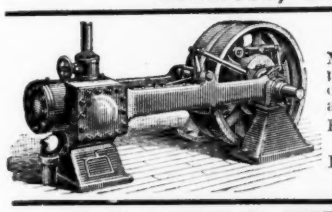

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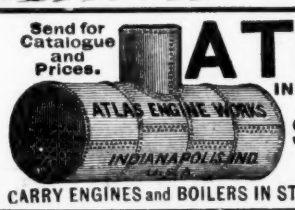

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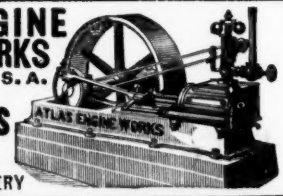

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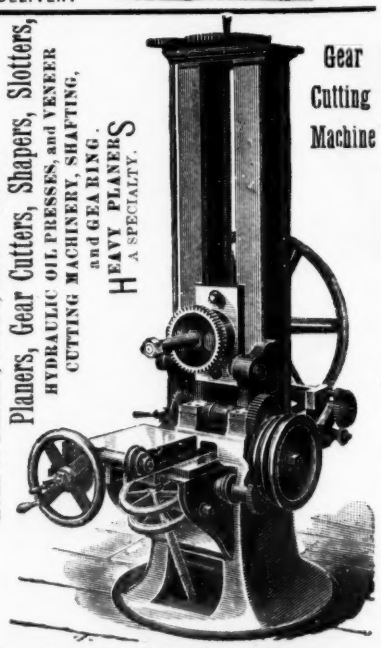

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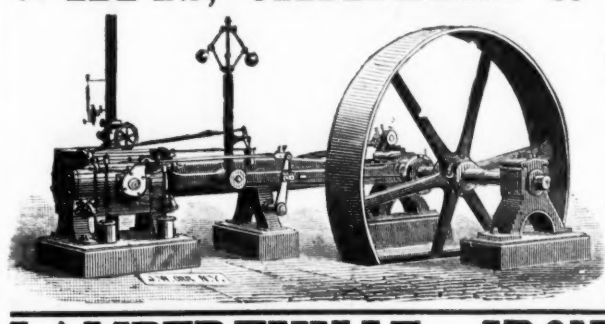

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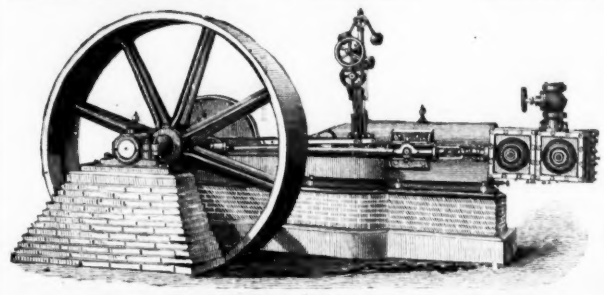

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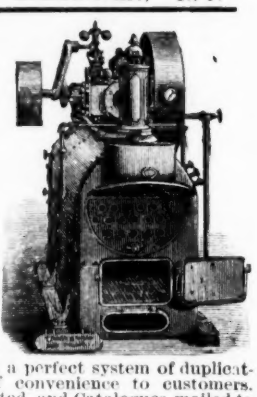

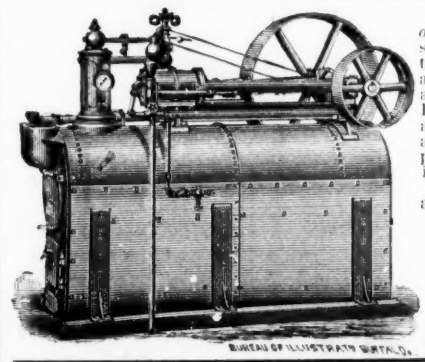

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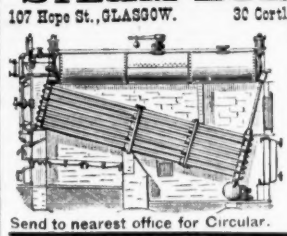

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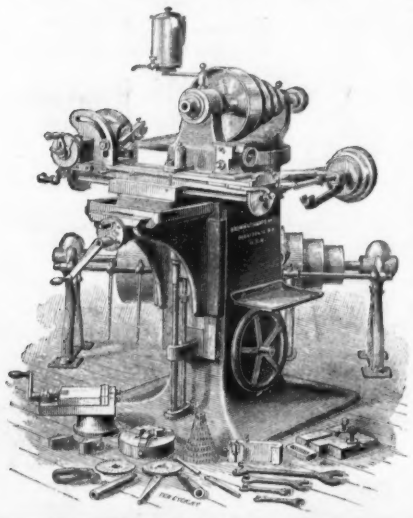

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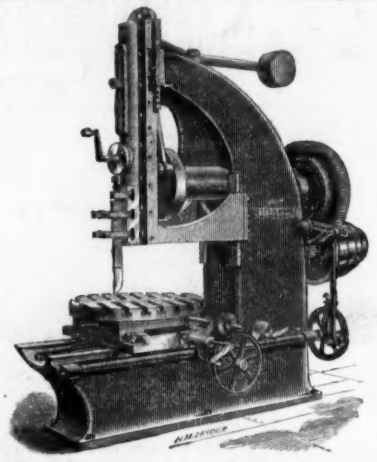

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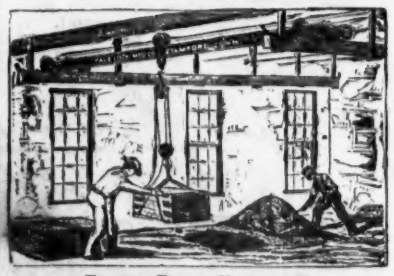

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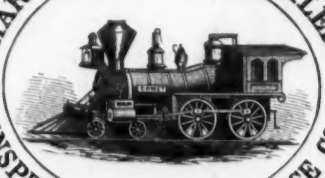

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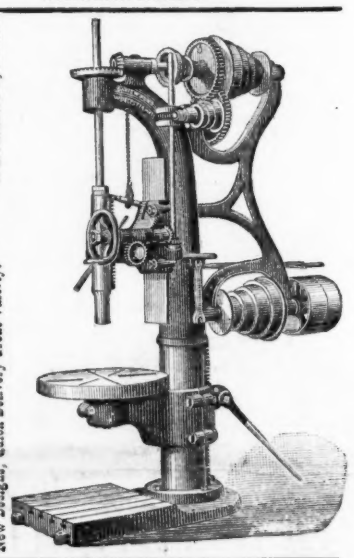

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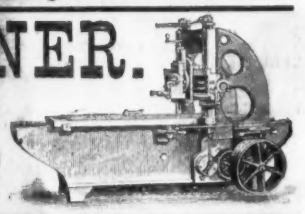

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